THE

FOUNDRY TRADE JOURNAL

AND PATTERN-MAKER.

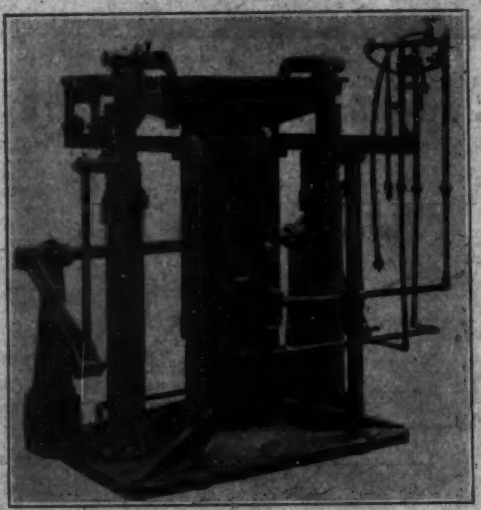
Vol. 21. No. 207. MARCH 1919. Price SIXPENCE Net.

JOHN MACDONALD & SON, LTD.

ENGINEERS,

WATT STREET, MARYHILL, GLASGOW.

"AJAX"
TURNOVER
JARRING
MOULDING
MACHINE.



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OF
BRITISH
DESIGN
and
MANUFACTURE
THROUGHOUT.

The illustration shows our latest design No. 6 "AJAX" Pneumatic Jar Ram Turnover and Pattern Drawing Moulding Machine. Simplicity and stability are the chief features of these machines, and they are built to stand the very hardest usage. The size of the turnover table is 25in. by 24in. with 14in. pattern draw, and lifting capacity of 8½cwts. at a working pressure of 80lbs. per square inch. Patterns can be drawn upwards from the moulds, or the moulds drawn downwards from the pattern. Moulds are successfully rammed in a few seconds, and are thoroughly uniform in density, thus saving at least 10% in overweight of castings. See our M—1 catalogue for further particulars and information regarding other sizes and types of "AJAX" Jarring Machines.

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Carbon free. 65/75% Cr. This alloy, which is easily crushed, is of the greatest advantage to makers of special steels with which Chromium must be introduced and carbon kept low. It is adequately suited and widely used for the manufacture of "stainless" or "rustless" steel.

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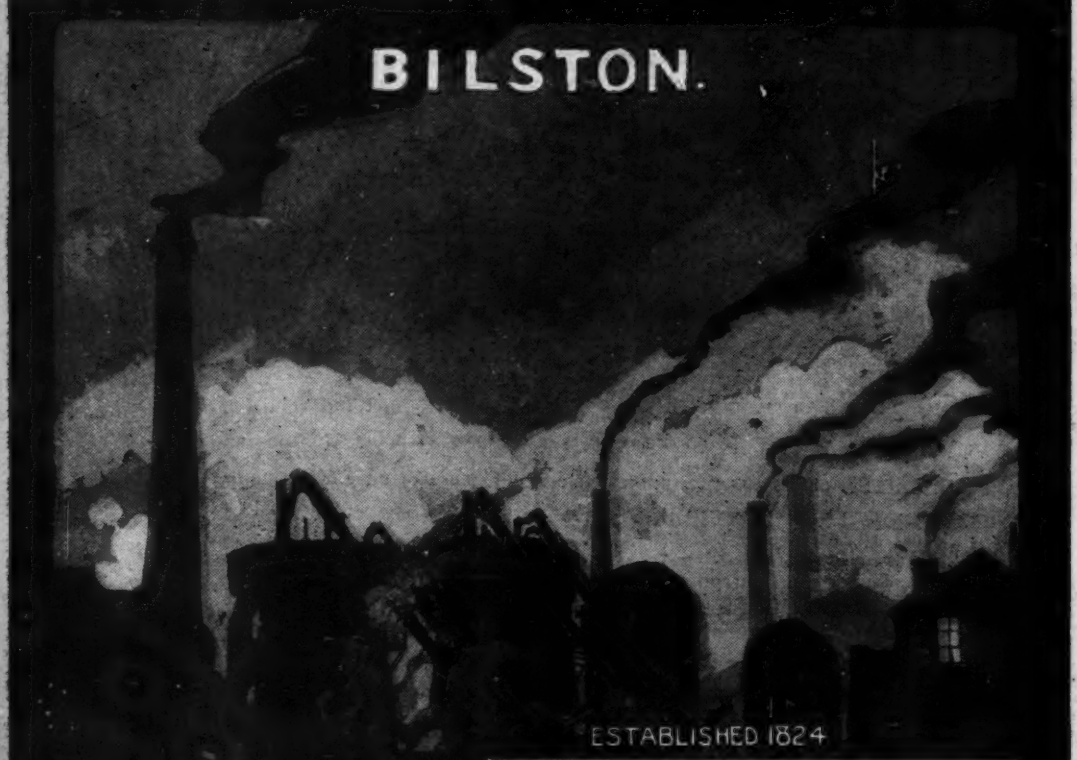

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FOUNDRITE is supplied in **LIQUID** form ready for use. Dilute with Water.

The porosity of the core is perfect, and cores so made do not shrink.

No blowing, cracking, crumbling, honeycombing, or loss of strength can take place.

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For ordinary work the price is about One Penny per gallon.

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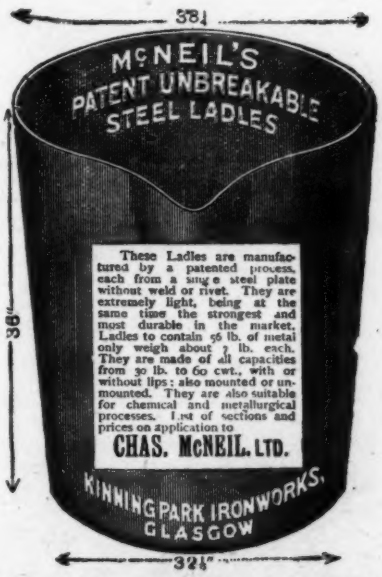
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Dear Sirs,

We have had enquiries regarding your system to which we have replied along the following lines:

"We subscribed to McLain's System principally to get the latest 'semi-steel' process. We have followed their system as closely as possible with very satisfactory results, having made over 150,000 Aerial Bombs of one pattern in 'semi-steel.'

"We have found Mr. McLain most anxious to help in every way and besides his twelve booklets on general foundry and cupola practice, we have had long letters with particular reference to our own practice with suggested improvements.

"We have found the cupola instructions so satisfactory that we have now our three cupolas operating according to his instructions, obtaining better and hotter meta with distinct savings in coke.

"By adopting their system we have been able to undertake large and profitable business and the *small outlay* we reckon can be saved in coke consumption *in a few weeks.*

"We have been using Scotch irons chiefly, with 15 to 30 per cent. good clean steel scrap in fairly large pieces.

"The tensile, transverse, and deflection tests are very good and the physical structure shown by micro-photographs shows the metal in its strongest formation, grain very close, with graphitic carbon finely broken up.

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"From our experience we have every confidence in recommending McLain's System."

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Price of McLain's System is $100. Save time and send order now with the name of your bank and let us forward the system complete with slight draft attached.

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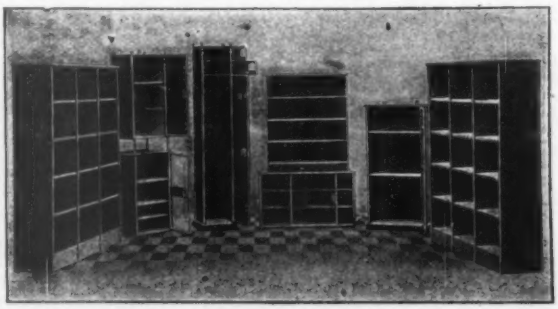

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NO SMOKE. SAVING 50 per cent.

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The HOME SECRETARY

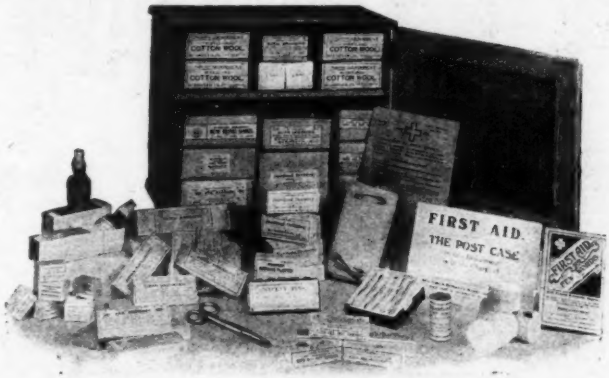
issued an Order, dated October 12th, 1917, requiring the provision of

FIRST AID OUTFITS

in all Metal Foundries.

MAY, ROBERTS & CO., Ltd.

can tell you exactly what is required of you under the Order and can supply you with the means of complying with it.



SIZE B.

CONTENTS OF CABINETS.

SIZE A.

Suitable for 50 or less Workers. Polished Wood Case. Size 9 × 6¼ × 6¼ ins.

1 Copy First Aid Leaflet (H.O. 923).
1 „ First Aid Instructions.
3 dozen Small Sterilized Finger Dressings.
1 dozen Medium „ Hand and Foot Dressings.
1 dozen Large „ Body Dressings.
1 Bottle No. 1 Eye Drops
3 Packets Sterilized Cotton Wool.
1 Notice Card for Factory use.

21/- Each.

3 or more, 20/- each. 6 or more, 19/6 each.

All Dressings are Sterilized and in Cartons.

Size "A" CASES are fitted with the MINIMUM REQUIREMENTS UNDER THE ACT

SIZE B.

Suitable for 150 or less workers. Polished Wood Case. Size 13 × 11 × 7 ins.

1 Copy First Aid Leaflet, (H.O. 923).
1 „ First Aid Instructions.
3 dozen Small Finger Dressings.
3 „ Medium Hand and Foot Dressings.
1 „ Large Body Dressings.
1 „ Small Burn „
½ „ Med. „ „
½ „ Large „ „
½ „ Sterilized Eye „
1 Bottle No. 1 Eye Drops.
1 Bottle No. 2 „ „
1 Dredger Bicarbonate of Soda.
½ dozen Sterilized Cotton Wool.
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2 only Triangular Bandages.
1 Box Iodine Ampoules.
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1 Pair Dressing Forceps.
1 Pox Safety Pins.
1 Notice Card for Factory Use.

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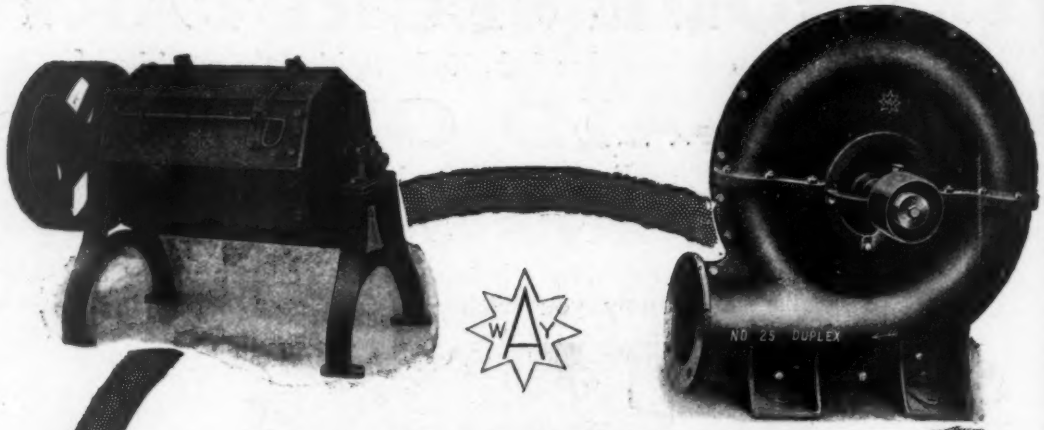

ALLDAYS

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The accompanying illustrations give but a brief idea of the wide range of Foundry Equipment made by us, which includes:—

BLOWERS, CRANES, CUPOLAS, FANS, MELTING FURNACES (oil, gas and coal fired), LADLES, SAND MIXERS, SMALL TOOLS, Etc., Etc.

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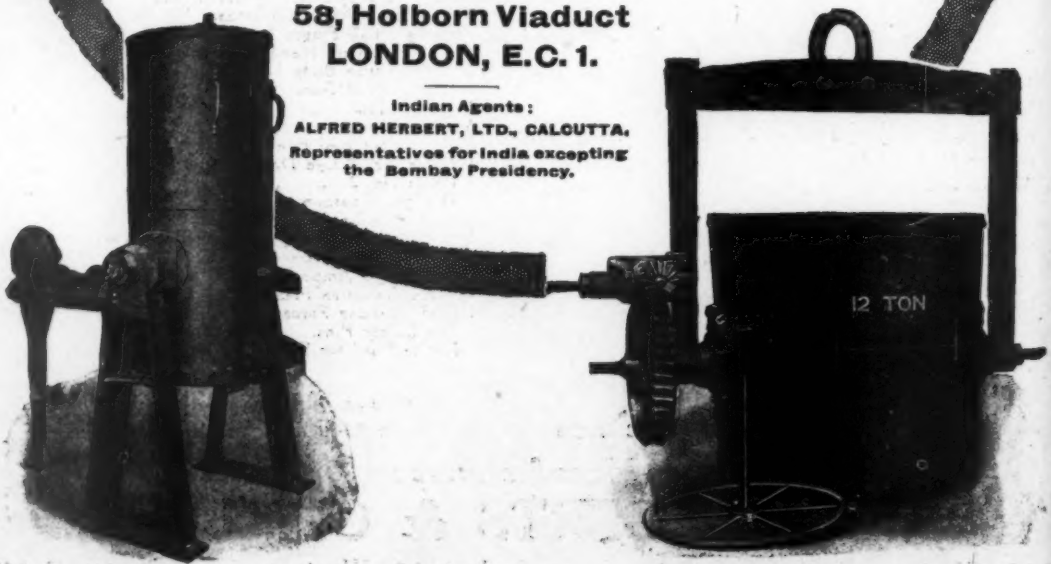
Representatives for India excepting the Bombay Presidency.



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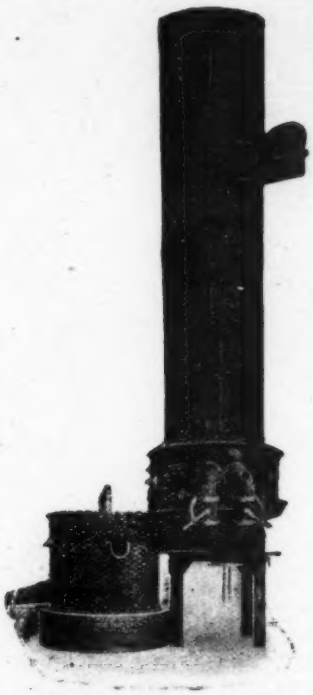

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WITH OR WITHOUT RECEIVERS OR DROP BOTTOMS.

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FOR ENGINE, BELT, OR ELECTRIC DRIVING.

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AND FANS.
HIGH SPEED ENGINES
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BOILER FEED PUMP.
CATALOGUES ON APPLICATION.

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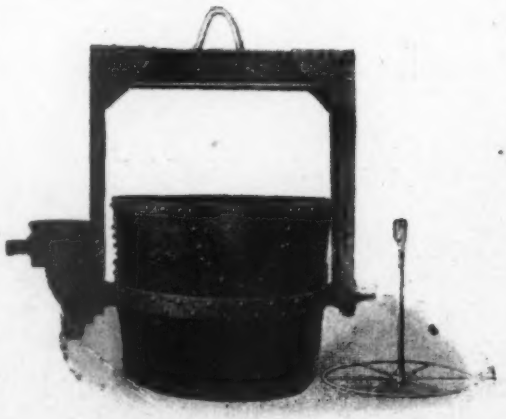

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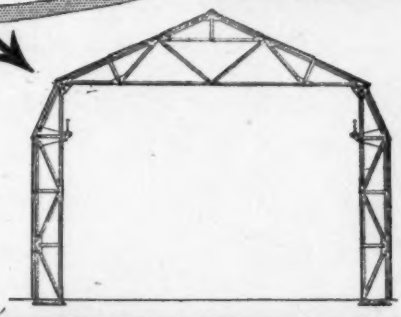

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SHOULD BE EQUIPPED WITH

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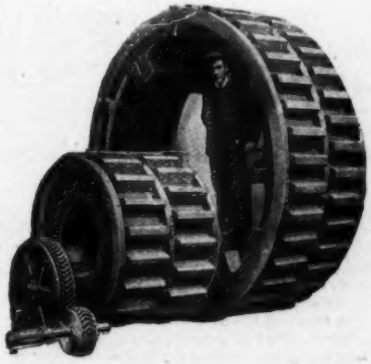
Complete Satisfaction Guaranteed



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ALL MINE.	WARM BLAST.	COLD BLAST.
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☛ IF YOU HAVE DIFFICULTIES WITH YOUR SPECIAL CASTINGS CONSULT US.
We can put you right.

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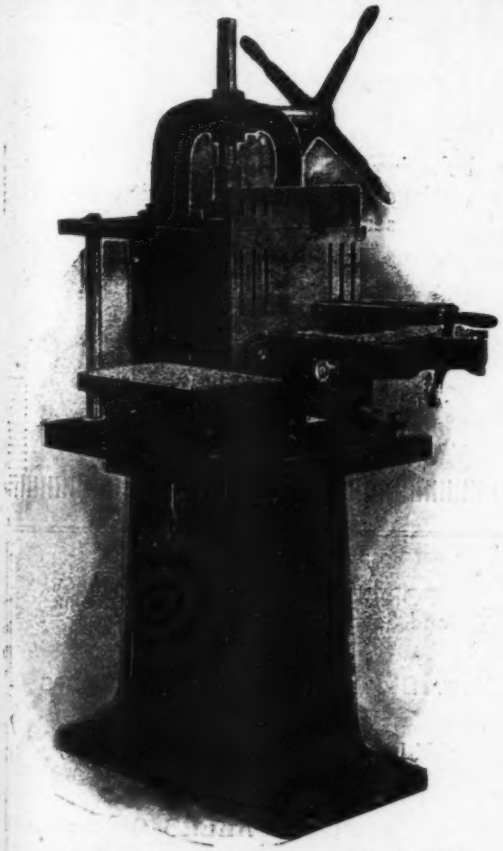
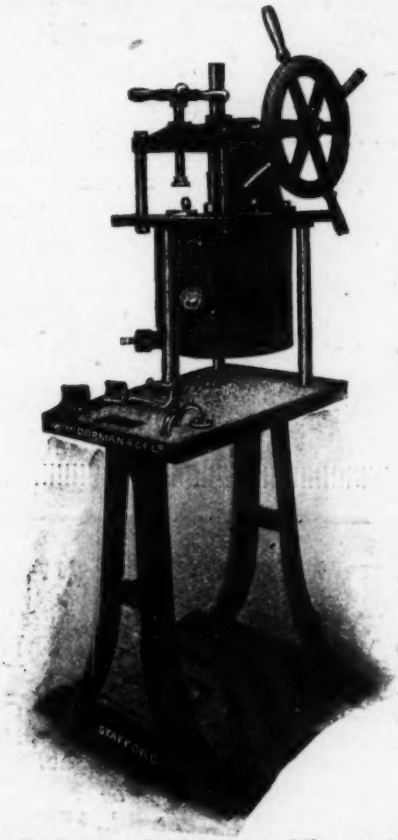
Contractors to the War Office, Admiralty, Ministry of Munitions and Air Ministry

FOR THE PRODUCTION OF DEAD-SIZE DIE-CASTINGS IN TIN, LEAD & ZINC ALLOYS

These machines have proved to be a practical profit earning proposition. At great speed and low labour cost they produce castings of splendid quality and exact size ready for use without machining.



Size No. 2 makes Castings up to 20-lbs. weight.



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MOULDERS'

PATENT WOOD, MINERAL AND

COAL DUST BLACKINGS

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SUPPORT BRITISH INDUSTRIES ?
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We are ACTUAL MAKERS OF BEST STEEL WIRE BRUSHES & BROOMS

and are in a position to quote Very low Prices.

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They are now being used by the Leading Ironfounders of Great Britain.

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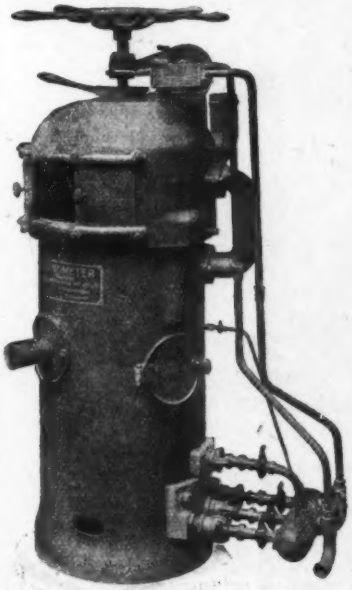

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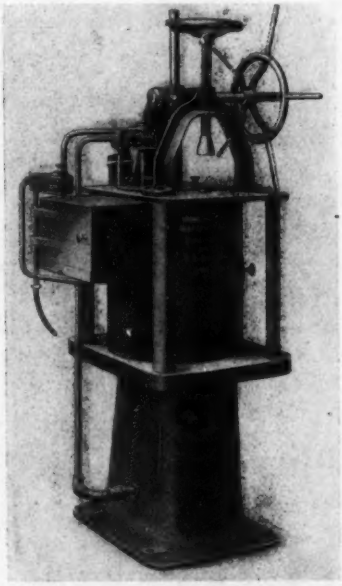

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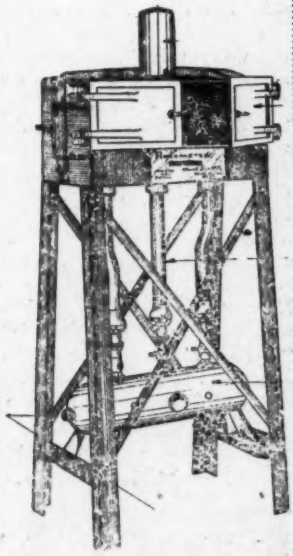

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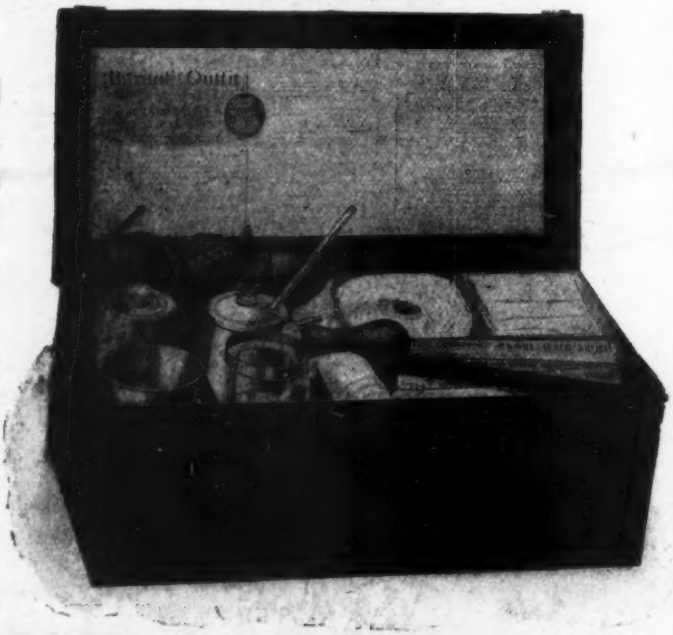

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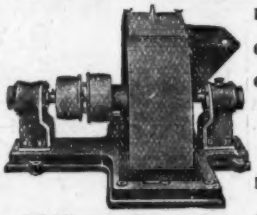

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NOTES AND COMMENTS.

Peace and Progress.

Industry at the moment is faced with many big problems, resulting from the vast upheaval of the past four and a half years, and the change from war to reconstruction. As Mr. Churchill pointed out recently, as soon as the sound of "Cease fire" reached the precincts of Whitehall the flow of material into munition works was immediately stopped, so that it might be diverted to peace production. Within a few days all restrictions on the use of many of the most important materials were swept away, and all stocks of materials in contractors' works were rendered available for peace purposes. Our effort had culminated in the discharge during fifteen successive days of more than 12,000 tons a day of shells from Sir Douglas Haig's artillery, and suddenly this whole great operation had to be brought to a standstill. During October the average production of filled shells was over 47,000 tons a week. Hundreds of thousands of persons have left munitions production, and so far as the figures of the Labour Exchanges are a guide, a very much smaller proportion of persons have placed themselves upon unemployment benefit from all causes than have been demobilised from munitions industries alone. Already, before our peace industries have sprung up again, a great deal of alternative employment is open. In the case of one filling factory, it is stated, out of 11,000 workers who were demobilised, upwards of 7,000 were re-employed within three weeks.

As far as the engineering shops are concerned, says Mr. Churchill, we are bound to have a period of dislocation extending over several months. Not only have new projects got to be undertaken, but the shops have to be cleared for new arrangement of machinery. But this difficulty would have been seriously aggravated if a similar disturbance and arrest of production had extended to the basic trade, the great steel trade. The arrangements which have been made to turn the steel trade on to peace appear to be working extremely well. Very large numbers of orders are being placed with the steel makers throughout the country, and there appears no reason at the present time to apprehend any sudden shock or setback in that industry. Orders are being booked for export, and, so far as home production is concerned, the steel works are already well occupied.

All restrictions on the purchase and manufacture of machine tools were removed almost immediately after the Armistice. The machine-tool trade is reported to be doing well, and to have numerous orders for peace work. Iron and steel and non-ferrous metals may now be ordered and supplied and used without priority classification or reference number from the Ministry of Munitions. Stocks purchased and held by Government contractors may be used for any class of work. The control orders for dealing in non-ferrous metals without a licence are suspended in the case of tin, copper, brass, cupro-nickel, platinum, spelter, lead, chrome-ore, and other metals. Freedom is restored in all these cases. Prices have been fixed for the non-ferrous metals which the Ministry had in their possession. Very large stocks of these non-ferrous metals were in Government possession, and have been put on the market at prices which, it is hoped, will have a direct effect in encouraging trade.

The Government is doing its utmost to develop alternative industrial production as a stop-gap pending the transition from war to peace industry. The superin-

tendent engineers of the Ministry of Munitions, distributed all over the country, are advising and assisting firms in their areas. The local boards of management are also co-operating. Special efforts are being made to obtain orders from Government Departments, from the Colonies and the Dominions, and from public bodies. Where necessary the Ministry of Munitions is prepared, in connection with Government schemes, to place covering orders for commodities which will clearly be required in considerable quantities if private orders are not forthcoming. For instance, arrangements have been made with the Railway Executive Committee, and with the Board of Trade, to place orders, if necessary, for 1,000 locomotives and 30,000 or 40,000 wagons in the shops of the country.

Arrangements are being made with the Local Government Board for the Ministry to place large orders for articles required in connection with the Government's housing schemes; such articles as steel casements, locks, and ironmongery, ranges, stoves, sinks, lavatory and sanitary equipment, fittings for gas and electric cooking and lighting, and many others. Contractors would be well advised to get into communication with the Ministry of Munitions should they desire to obtain orders of this nature. Some of the best brains in the Ministry and in its Inventions Department and in the firms in the country are devoting themselves to considering the adaptation of useless munitions to articles of commerce.

Demobilisation and Re-employment.

One of the important problems to be faced is the re-employment of men demobilised from the Forces; in fact, no more urgent task follows upon the demobilisation of the Forces than the re-instatement in civil life of the soldiers and sailors. The number of men to be dealt with in this country alone makes the labour gigantic, but the machinery exists for performing it, and it only remains for intending employers and employees to avail themselves of their opportunity. The Employment Exchanges, assisted by the Local Advisory Committees, which represent equally the interests of both parties in every neighbourhood, have the organisation ready for use. The staffs of the Exchanges have been considerably strengthened in order to meet the extra strain thrown upon them. It is not generally known that branches have been set up to deal with discharged men only, and in a great number of cases special sections for disabled men having been established. As far as possible, the work in these new additions to the Exchange system is carried on by men in the same position as those whom they are helping back to civil employment. Discharged men, with no small proportion of disabled among them, superintend the placing of discharged and disabled men. It has been found that the loss of an arm, of a leg, of two legs, and even of eyesight is no insurmountable obstacle to the performance of efficient work, given employers who will employ the men, and the Exchanges which make use of such men are patent examples of the fact that war, even when it has dealt serious bodily injuries, does not unfit the fighter for successful life as a civilian.

Juvenile Employment.

The war has also drawn into productive labour many boys who, under normal conditions, would have spent longer at school, or in preparation for industrial and commercial work; and these are likely to be very seriously placed by any disorganisation of the labour market. It is interesting, therefore, to note the "Summary of Recommendations" in a pamphlet just issued by the Ministry of Reconstruction on "Juvenile Employment" (No. 15 of the "Reconstruction Problems" series) :—

(i) All Government factories and other establishments should be instructed :—(a) To hold back the discharge of young persons until notified by the employment exchanges that vacancies are available. (b) When they discharge young persons to discharge them in small groups at a time. (c) To set up, in co-operation with the local education authorities, a system of part-time day continued education.

(ii) Provision should be made forthwith for setting up Juvenile Employment Committees in those areas where no committee exists and where a considerable number of juveniles are employed.

(iii) The Juvenile Employment Committees should be recognised as the authority for supervising the development of the industrial situation and for evolving plans for its control. To this end they should immediately form an estimate of :—(a) The number of young persons likely to be discharged. (b) The probable demand for juvenile workers. (c) The number of those for whom no alternative employment will be available.

(iv) With a view to checking the competition of boys and girls leaving school with those already in industry, and so securing, as far as possible, that the latter shall find employment :—(a) All bye-laws permitting exemption below 14 should be immediately suspended. (b) Clauses 8, 10, and 13 of the Education Act, 1918, should be put into operation at the earliest possible moment. (c) The Board of Education should urge on the local education authorities, as at least a temporary measure, to use the powers conferred by the Education Act, 1918, to raise the age of full-time attendance to 15, and to provide maintenance allowances.

(v) With a view to withdrawing from industry young persons now engaged in it, and providing for their higher education, the Government should, as soon as possible, make provision for enabling an increase to be made in the number of scholarships and maintenance allowances tenable at places of higher education.

(vi) The Factory Acts should be amended in such a way as to :—(a) Establish a normal working week for young persons of, at any rate, not more than 48 hours (work and school). (b) Abolish night work for young persons. (c) Bring within the protection of the law young persons who are at present outside the scope of the Acts.

(vii) Maintenance grants should be provided for all young persons thrown out of employment, and provision made for setting up :—(a) Centres for instruction and recreation for all young persons who are unemployed. (b) Residential camps.

Proposed Technical Institute for Middlesbrough.

The progress made in the movement to acquire a Technical Institute in Middlesbrough was brought before a social function held under the auspices of the Cleveland Institution of Engineers recently, when it was announced that it had been decided to purchase a Methodist Chapel in Corporation Road for the object in view.

Mr. J. H. Harrison (President), after reviewing the history of the movement, remarked that it was proposed to alter the building as necessary for the purpose intended, and it should be under the management of a Joint Committee to form the headquarters of the Cleveland Institution of Engineers, the North-East Coast Institution of Engineers and Shipbuilders, and for the use also of other technical societies having their headquarters or branches in the town or district.

Dr. Stead remarked that it was thought at first that £10,000 would be sufficient to equip properly the premises they had secured, but they could now see that to establish an institution worthy of the district some £20,000 would be required. Should the necessary support be obtained, the Committee had in view the use of the hall for workmen's lectures during the winter months. Having outlined the proposed programme of lectures, Dr. Stead referred to the fact that other towns were moving on the same lines. The cutlers of Sheffield had promised to erect a suitable building for the newly-formed Society of Metallurgical Chemists and Steel Smelters, with a lecture-room, reading-room and library. Swansea was spending a large amount of money for technical education, and Middlesbrough must not lag behind in the race.

Castings Used in Ship Construction.

By Ben Shaw and James Edgar.

Moulding Stem Pieces.

The preparation of moulds for stem pieces provides one of the most straightforward jobs with which steel moulders have to contend, in connection with large castings for ship construction. This is largely accounted for by the simplicity of their design, reducing to a minimum difficulties due to contraction. Although in a comparative sense these stem-piece castings are less difficult to prepare and cast, they are not so simple as one may imagine, as owing to their length and proportionately small sectional area, tapering off gradually in thickness towards one or both extremities, considerable care is necessary in running the metal. The difficulties would be almost surmounted if a good number of risers or feeder heads were used. It is not profitable to reduce the number of feeder heads, to save the cost of cutting them off the castings, and run the risk of having a waster; the cost of removing the heads from the casting should be a matter of secondary importance. A sound casting is a matter of primary consideration. Increasing the number of risers assists occluded gases to escape, reduces resistance to the movement of the molten metal, and provides a body of metal at invervals from which the casting can draw metal during the time of solidification, thus increasing the prospects of obtaining a sound casting. The representative types chosen, while varying in their methods of preparation only to a minor extent, demonstrate the more common types of stem pieces required, and cover a variety of contours and sections.

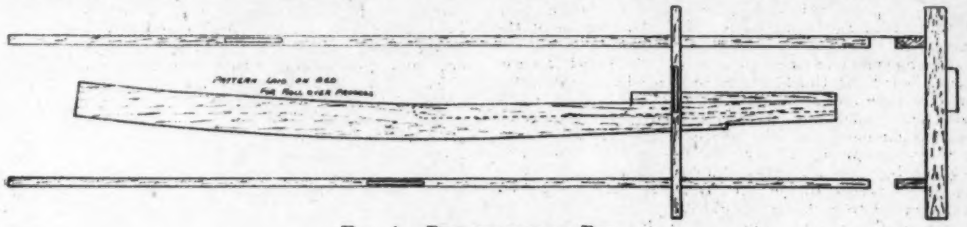

FIG. 1.—PREPARATION OF BED.

The patterns for all such castings are unavoidably weak and require very careful handling. Sometimes, in addition to being jointed, forming two symmetrical halves, they are made in two or more pieces for convenience of carriage by rail, and the moulder is depended upon for assembling the different sections, in order that a correctly shaped casting may be obtained. In all such patterns, where the sectional shape is of a varying nature, it is best to joint them through the centre, in order to assist the moulder to obtain an impression straight and out of winding.

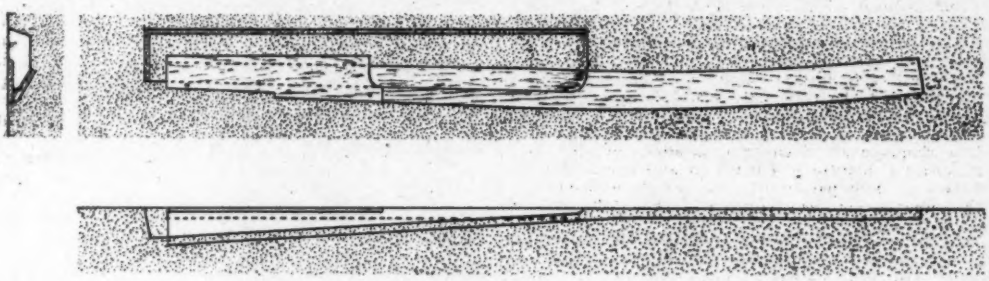

FIG. 2.—PATTERN BEDDED IN, AND PREPARATION FOR DRAWBACK.

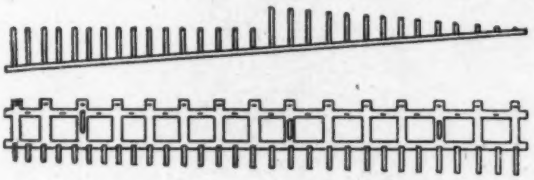

FIG. 3.—GRID FOR DRAWBACK.

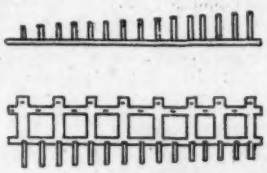

FIG. 4.—ADDITIONAL GRID FOR DRAWBACK OVER RIB.

In dealing with all the varying types the moulder first prepares a straigh bed, either for the roll-over or bedding-in processes. The level bed is essential, owing to the fragile nature of the

pattern. Fig. 1 shows the method for ensuring the necessary condition. The straight-edged logs shown are frequently edged with hoop iron, as is also the shorter straight-edge for scraping off the superfluous sand. The logs are bedded into the foundry floor, tested until their position is fixed, and the sand between them is then levelled off. The accuracy of the casting depends upon the preparation of this bed. If the roll-over process is adopted, then the bottom half of the pattern carrying the internal rib is laid upon the bed as shown in Fig. 1, the inside being filled up and

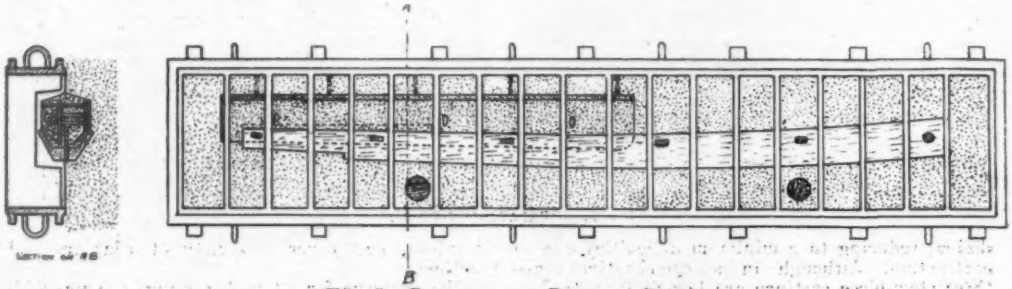

FIG. 5.—PREPARED FOR RAMMING COPE.

strickled off to provide a print for the core. A dusting of parting sand is given to the bed and improvised core, and the bottom box lowered over, preparatory to ramming-up. This method is certainly a very good one, because the ramming of the sand in this way is a comparatively simple operation, and secures a more regular density, because it is more accessible. There are, however, difficulties frequently encountered with regard to box parts of such dimensions. This method offers the additional advantage of being able to be moved for drying purposes or tilted for casting. The

pattern and make the size of the hole large enough to take in the composite which is to form the surface of the mould and come into contact with the pattern. Again lower in the pattern, and press down, until its joint surface coincides with the surface of the bed. Hammering directly on the pattern must be guarded against, as this is likely to interfere with its shape. It will be necessary to remove the pattern a few times to secure an equal density of sand.

Once it has been set to the satisfaction of the moulder, and a few pieces of metal laid upon it, the ramming about the outside can be proceeded with, cutting out the floor sand of the bed, and working in prepared facing against the pattern. The outside ramming tends to lift the pattern so that it is wise to test the surface to see that it remains level with the bed. Any slight inaccuracy should be rectified, and the joint strickled off.

Preparation can now be made for the core or drawback by cutting back the sand, as shown in the sections of Fig. 2, allowing sufficient bearing beyond the pattern to take the balance of the weight of core to be formed. Considerable taper

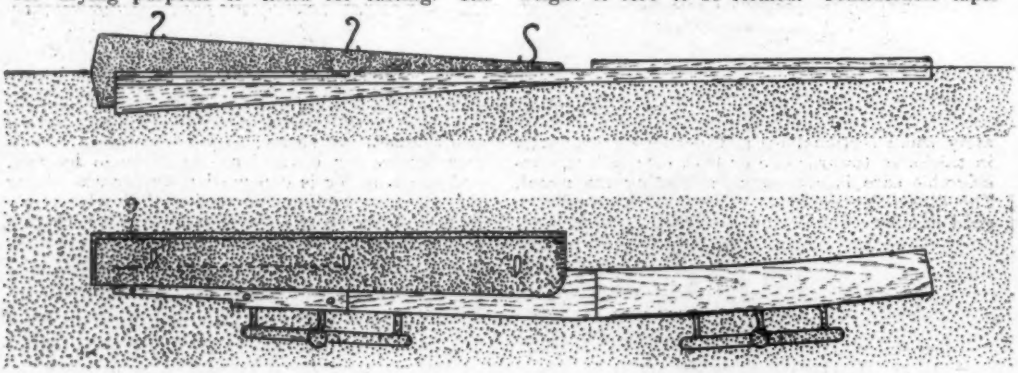

FIG. 6.—DRAWBACK READY FOR LIFTING.

increased expense, and sometimes absence of system with box parts, renders it imperative for the bedding-in process to be adopted.

In commencing this process it is better to mark the contour of the stem piece on the prepared bed, using the reverse half of the pattern to that which is going to be bedded-in. This provides a good guide in cutting out the sand, and enables the moulder to prepare for bedding the pattern in, without disturbing the bed more than necessary. Set-in the bottom half of the pattern and obtain an approximate guide for the depth. Remove the

should be given to the sides where possible. Sometimes the pattern is formed so as to provide an impression similar to that shown, a corebox being supplied to provide the necessary shape, but the method is not to be recommended in a job of this kind. There are times, of course, when a great saving of time is secured by supplying coreboxes for large steelwork, but the moulder has a clearer conception of what is required when the pattern is similar to the casting wanted. In this instance, preparing a core in the mould is not a difficult

task, nor does it retard the progress of the work of making the mould to any appreciable extent.

There is a considerable advantage, when dealing with irregular cores of this kind, in preparing cores in the form of drawbacks in their correct position. They are then more likely to bear a closer relationship to the rest of the mould than would otherwise be the case. Having cut out the print as indicated in Fig. 2, dust it well with parting sand. Sometimes a thin coating of ordinary sea-sand is sleeked over the tapered sides, leading to the joint, and a good lift is ensured. The rib should be removed during the process. A grid is required to take the shape of the core, and since the shape varies, it is a good plan to cast in wrought-iron pieces along the inside, so that they can be bent conveniently to suit the shape of the core. The grid requires to be made in two pieces, the customary method being shown in Figs. 3 and 4. Try the bottom grid in position, and adjust the prod to requirements preparatory to making a beginning with the drawbacks. It is advisable to use a more plastic form of composite in this case to avoid ramming, and a good layer should be applied about the bottom to receive the grid, which should be clay-washed and bedded-in. Apply more composite, and gradually work up to provide a bed for the rib, which can be screwed into position on the pattern. The top half of the pattern can be laid in position, and the shape of the top grid adjusted. Layer the top of the rib with composite and bed-in this grid, securing it to the bottom grid so that the rigidity of the drawback as a whole may be ensured.

Sometimes these drawbacks are built up with bricks upon a plate. With the former method, however, the centre of the core can be filled with cinders, and connections made with the joint of the mould, as shown in Fig. 5, so that gases and increased volume of air, due to the high temperature when casting, will escape easily. Work in composite beneath the top half of the pattern, a good, dense contact with the pattern being desirable, care being exercised to preserve the shape of the pattern, as it is weak and liable to become misshapen with the pressure applied, or raised from the joint. A sufficient covering of this composite should form the surface of the drawback to ensure strength. Form it up as shown in Fig. 5, giving a good taper along the sides to prevent injury when lifting the cover box. When this is accomplished the top half of the pattern may be temporarily removed, and the drawback made up, where necessary, along the inside, hot bricks being applied to stiffen the surface of the core, in order that the work of covering may be proceeded with more readily and with less danger to the drawback. Clear out the sand surrounding the tops of the staples in the grid and cover with pieces of sheet iron.

The cover box, which may be set into position as soon as the drawback is sufficiently skin-dried, and the pattern returned to its place, can be cast solid, as shown in Fig. 5, depending upon the length of the job and the stock of boxes; or two or more solid boxes may be used; or, instead of either of these methods, a frame box with loose bars bolted in would suit admirably. Whichever method is adopted will need to be well staked to ensure the relative position of the boxes being retained when lifted and returned. Dust the drawback well with parting sand, set gate sticks, lay the headers in

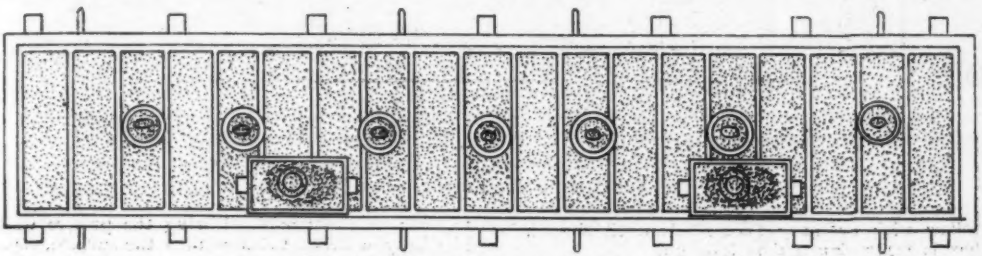

FIG. 7.—PREPARATION FOR CASTING.

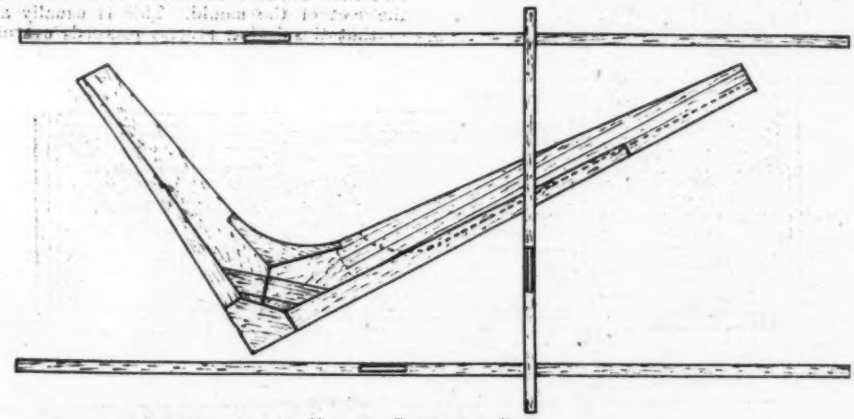

FIG. 7.—PREPARING BED.

position, fixing them with composite, as shown in Fig. 5, and begin to ram up the box. A good supply of gaggers is required to support the sand in the top to the joint. These should be clay-washed and suspended from the box bars and against the sides. Apply the composite first, and

Special attention should be given to these runners, with regard to the quality of the composite used and its high refractory nature. Loosen the screws holding the rib and lift the drawback to release the bottom portion of the pattern. With both sections of the pattern withdrawn, proceed

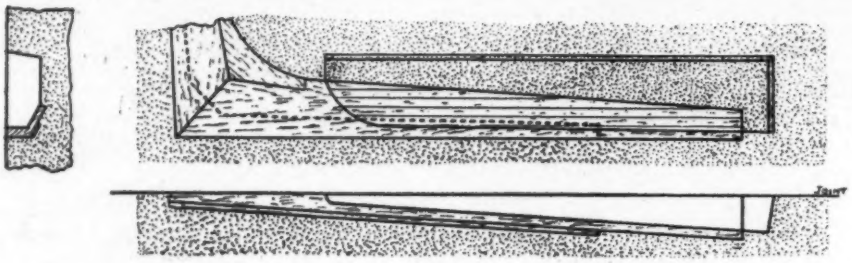

FIG. 9.—BEDDED IN AND PREPARED FOR DRAWBACK.

follow with ordinary floor sand, until the whole box is rammed up; then level up.

This accomplished, the gate sticks and risers withdrawn, the box may be lifted and rolled over. If the box is in one piece, or can be secured to re-

to sleek-up the mould. During the process work in plenty of brads to strengthen the surface, especially at the square corner formed to take the ship's plates. This corner should be maintained as sharp as possible in the casting; hence the sand should be well supported. Clear away or strengthen any impediment to the inrush of metal in both cope and drag, stamp a number of dabbers along the bottom, and set the cope on standards over the drag, ready for fixing. The sides can be practically sealed, and the mould dried in place. The core or drawback can be set upon a bogey and transferred to a drying oven, or if too unwieldy and thus difficult to handle it can be dried with the rest of the mould. This is usually arranged so that the drying process proceeds overnight, in

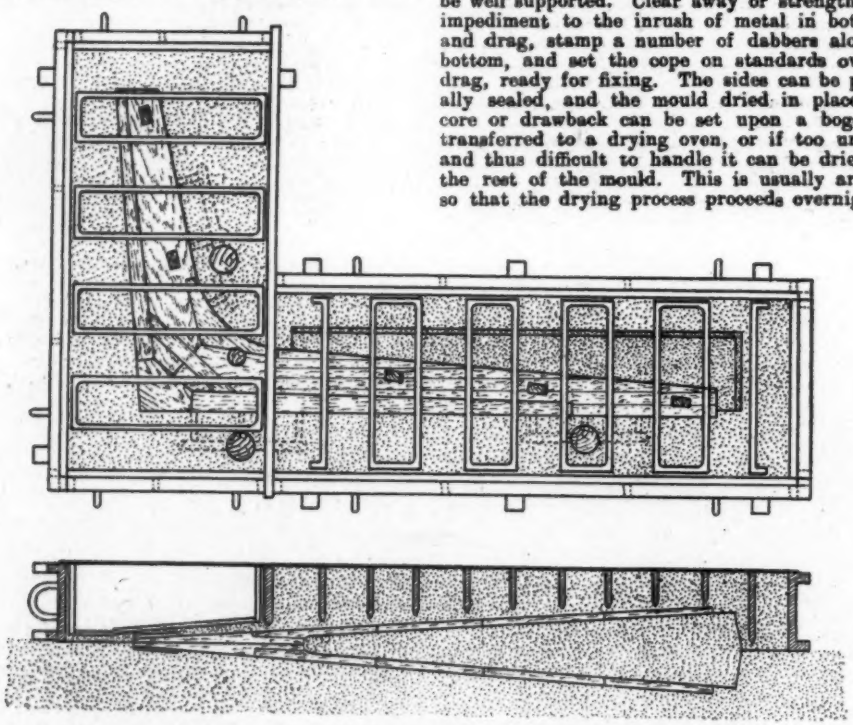

FIG. 10.—COVERED; SHOWING GATES AND RISERS.

semble a solid box, then the top half of the pattern may be lifted with it, provided screw eyes are inserted into the pattern from the top, and secured to hold the pattern while being turned over. Compress the sand about the joints, and prepare the runners as shown in Fig. 6.

order that the work be not delayed. When thoroughly dry, and while still warm, apply a coating of special blacking to both mould and drawback, carefully sleeking the while, and filling in any fissures which may have been caused through drying the mould.

After the satisfactory application of this blacking the whole is again dried. In the meantime preparation is made for casting, by securing the tackle for gateheads and riser heads, and making them up with composite to the required shape. The mould being thoroughly dry, proceed to close the

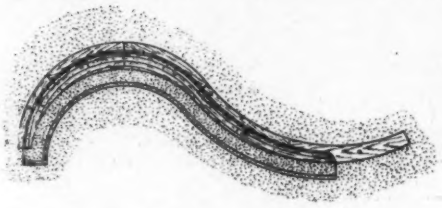

FIG. 11.—HALF-PATTERN BEDDED IN, AND PROVISION FOR DRAWBACK.

job, setting in the drawback and, if necessary, tying it with the outside and then lowering on the corebox. Try the gates with chalk and lift to see that all is clear, finally lowering again. Set the prepared pouring basins and riser heads as shown in Fig. 7, grout them with composite, and proceed to weight the job preparatory to casting. Two ladles will suffice to supply the necessary metal.

With regard to the stem piece shown in Fig. 8, the method of preparing the mould is similar, the bed with the pattern set being shown in this illustration. The bedding-in process being resorted to

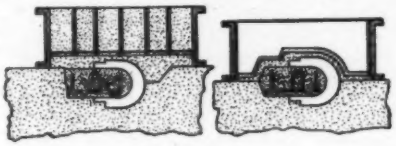

FIG. 13. FIG. 15.
TWO JOINTING METHODS.

in this instance also, Fig. 9 shows the pattern made up to the joint, and the sand cut away for the drawback. This stem piece lends itself more readily to a solid pattern and separate corebox, because the internal shape is more regular. The core can be made in the form of a drawback equally as easily as in the former instance, and it is the method usually preferred. Proceed to make up the core, setting in a grid and forming the joint as previously mentioned; set gate sticks and risers and set on the top box. Two pieces are usually

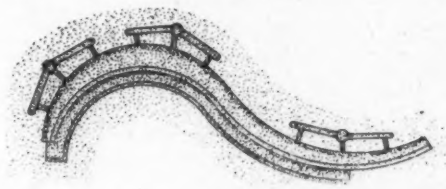

FIG. 16.—MOULD PREPARATORY TO CLOSING.

employed, as indicated in Fig. 10. These two parts can be secured together and lifted as one box, or, by separating them and using special box bars carrying prods, a joint may be made and each box lifted separately. Care must be taken, however, to ensure a correct return to their positions when replaced for casting. The gates, three being sufficient, are shown in Fig. 10, together with the headers.

The description of stem piece shown in Fig. 11 is much larger and more awkward to cast, and is

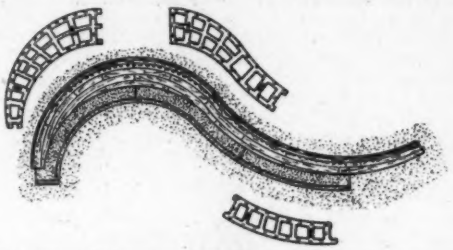

FIG. 12.—DRAWBACK PREPARED; SHOWING SUITABLE GRIDS.

invariably bedded into the foundry floor, because of the size. The prepared bed is equally as essential as in the former instances, the top half of the pattern being laid on to obtain the contour for cutting out. In this instance the drawback if

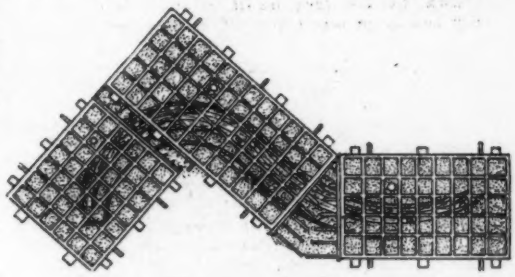

FIG. 14.—ARRANGEMENT OF BOXES.

made whole would be very awkward and unwieldy, hence, for convenience, it is separated into three pieces. Fig. 12 shows the pattern bedded in and the sand cut away to form the drawback, together with suitable grids for dividing it into three por-

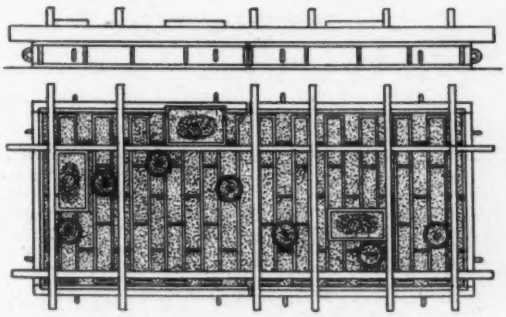

FIG. 17.—READY TO RECEIVE MOLTEN METAL.

tions. In these grids for this class it is an advantage to cast in pieces of wrought iron for convenience in taking the shape of the inside of the stem piece. The jointing of this piece may follow the surface of the drawback, as shown in Fig. 13, and dropped down to coincide with the centre of the

pattern, raising or lowering towards the joint of the boxpart to provide a level bearing. This method reduces the amount of top lift and allows for the use of a number of solid boxes having bars cast in. In this instance the cope, if made in one box, or a number of boxes fastened together for lifting purposes, would be an expensive undertaking as regards tackle, and would tax crane equipment that would otherwise be capable of dealing with work of this character.

A method of using a number of solid boxes is shown in Fig. 14, having grids firmly secured to them at those places where a joint is necessary. In this way each piece can be lifted separately, and it is a convenient means of using in stock boxes. When it is desirable to make the joint of the mould coincide with the joint of the pattern, then a greater part of the mould will be carried in the cope, and more care is necessary in the selection of the box to carry it. The joint may be made as indicated in Fig. 15, resembling the former instances. A framed-up box having loose box bars will meet requirements, providing stocks will meet the demand, and it may be possible to secure them in sizes capable of making two parts large enough for the job, as shown in Fig. 17. Loose double bars for large boxes require to have stiffeners cast with them, and when bolted in the box a number of wood bars are fixed between them to assist in supporting the sand.

Both methods for forming a cope for such a stem piece are used, but in each instance care must be exercised in providing a good support for the sand, where the boxes join each other, by casting short bars on the last bar of each part, and at right angles to them, as shown in Fig. 17; or, when this method cannot be conveniently adopted, as in the case when solid boxes are used, grids should be carefully secured, as shown in Fig. 14. The methods of jointing shown in Figs. 13 and 15, are both adopted. When the former style is preferred a flat bearing should be carried off the centre before being bevelled up to the level suitable for the cope box, as shown in the sketch. In preparing the runners for a large casting of this type, a good supply of metal is required, and yet the number of gates should be as few as possible. The method of running shown in Fig. 16 is one frequently adopted, and is preferable to the single-gate system sometimes used, supplying a very long runner with a series of connections with the mould. Long runners are often the cause of contraction difficulties, and cause unnecessary strain in a casting. The arrangements for casting this job are shown in Fig. 17, three ladles being used to supply the metal.

The weighting of the cope requires special attention. A safe rule, which serves as a very useful guide, is to multiply the lifting area, i.e., the area of the cope with which the metal is to come into contact, with the height of head on the gates, and them by the weight of a cubic inch of steel. Allow a good margin for safety, including the weight of the cope itself, bearing in mind that it is better to have too much margin than too little, to allow for the momentum of the metal.

PATENT LAW AMENDMENT.—We have received from the secretary of the Institution of Mechanical Engineers, 11, Great George Street, S.W.1, a pamphlet relating to the Technical Institution's Conference, and giving a memorandum on Patent Law Amendment. The memorandum is based upon a report prepared by the Institution of Electrical Engineers, and kindly put at the disposal of the Conference by that Institution.

Scientific Management.

A feature of the recent Industrial Conference is the demand of Labour for shorter hours and higher wages. Lord Leverhulme and other broad-minded employers believe that this can be done without lessening output. Appeals are made to the working man to abandon the ca' canny attitude and other means of restricting output, and it is pointed out to them that the average output per man in America is three times that of a man in England working under similar conditions. But the working man is not to blame for this We must have in all industries greater efficiency, based not so much on individual effort as on scientific management. America and other countries have led the way in this respect, and the astonishing results obtained by English firms who have adopted these methods should be more widely known. It is a mistake to suppose

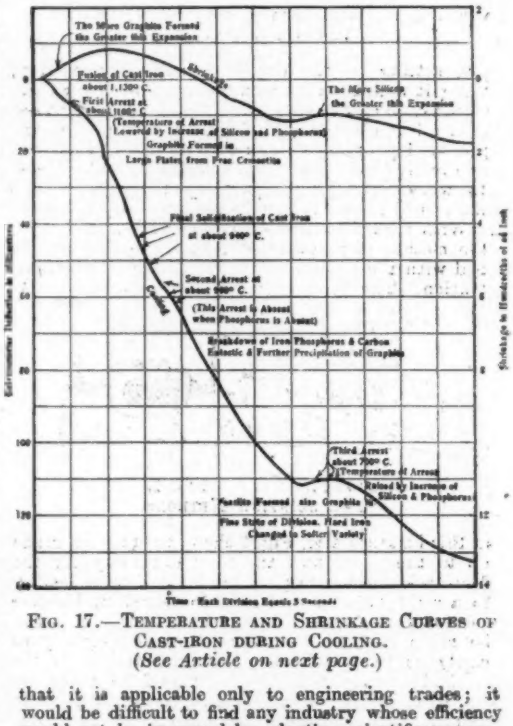
The More Graphite Formed the Greater the Expansion
Point of Cast Iron about 1,130° C.
First Arrest at about 1108° C.
(Temperature of Arrest Lowered by Increase of Silicon and Phosphorus)
Graphite Formed in Large Flakes from Free Cementite
The More Silicon the Greater the Expansion
Final Solidification of Cast Iron at about 940° C.
Second Arrest at about 940° C.
(This Arrest is Absent when Phosphorus is Absent)
Breakdown of Iron Phosphorus & Carbon Eutectic & Further Precipitation of Graphite
(Third Arrest about 700° C. Temperature of Arrest Raised by Increase of Silicon & Phosphorus)
Pearlite Formed also Graphite
Fine State of Division. Hard Iron Changed to Softer Variety
Time : Each Division Equals 5 Seconds

FIG. 17.—TEMPERATURE AND SHRINKAGE CURVES OF CAST-IRON DURING COOLING.
(*See Article on next page.*)

that it is applicable only to engineering trades; it would be difficult to find any industry whose efficiency would not be improved by adopting scientific management. The Industrial Reconstruction Council, 2 and 4, Tudor Street, have taken up the matter, and at a public meeting held at the Institute of Journalists recently, elected a sub-committee to arrange a series of fortnightly conferences which would deal with this subject in all its bearings. Further particulars may be obtained from the Organising Secretary, I.R.C., 2 and 4, Tudor Street, E.C.4.

A NEW INDUSTRIAL PUBLICATION.—The first issue of Mr. Ernest J. P. Benn's new weekly, "Ways and Means," was published on March 7. Among the contents are, "The Responsibility of Trade Unions towards Industry, by the Rt. Hon. J. R. Clynes, M.P.; "Industrial Councils," by the Rt. Hon. J. H. Whitley, M.P.; "How we Supplied our Allies with Coal," by Sir Daniel Stevenson, Bart.; "The Financial Situation," by Sir George Paish; "A Step Towards Industrial Rest," by Mr. Cecil Walton; and numerous articles by authorities on current industrial topics.

Properties of Cast-Iron Test-Bars.*

By H. J. Young, F.I.C.

To meet a demand for definite information about testbars the author attempts to review the subject in such manner as may be understood by those foundrymen interested. In all probability the testbar is the most difficult casting the foundry makes or the machine shop machines. The value of a test is proportional to its accuracy, and its accuracy is generally proportional to the knowledge and skill of those responsible for it. The results obtained from a testbar produced under unknown conditions, the effects of which are a mystery to all concerned, are unsatisfactory from any point of view, and when the metal in question happens to be cast iron the results are valueless.

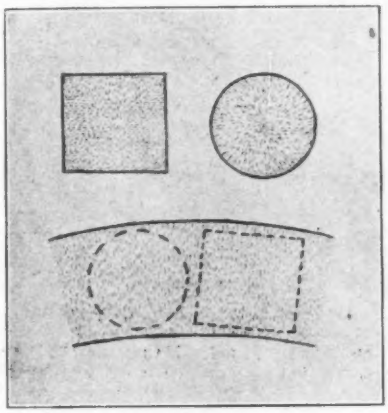

FIG. 1.

Testbars Cast on Castings.—There are several kinds of testbars, and a familiar one is that specified to be cast "on the casting." The specification does not state the manner and situation in which the bar is to be attached to the casting. Also, the same specification applies to any casting of any shape, any weight, and cast in any manner the foundry chooses to adopt. A discussion of such testbars would seem to be profitless.

Testbars Cut from Castings.—In the case of the failure of a casting it is common practice to cut a testbar from the casting itself. In the not uncommon event of being without data to tell us what result ought to be given by a testbar cut from a particular situation in a particular casting, we are practically unable to pass an opinion upon the result obtained. Fig. 1 gives an idea how the assembling of the crystals in cast testbars may be very different to that in testbars cut from castings.

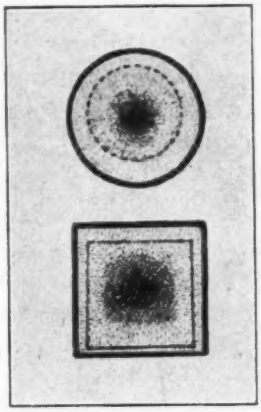

FIG. 3.

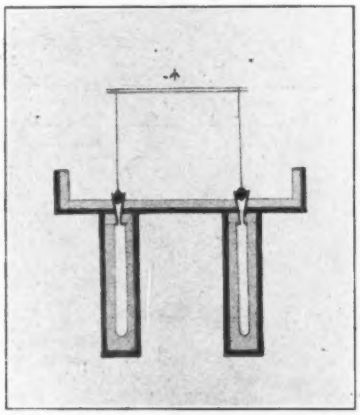

FIG. 2.

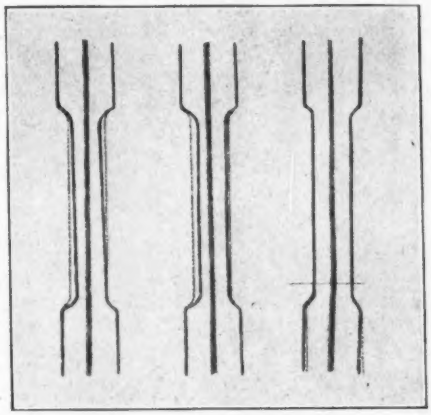

FIG. 4.

Testbars Cast from the Ladle.—Testbars taken from the ladle possess the advantage of being comparable one with another, and the foundryman wishing to gain knowledge does well to adopt this method. He would need to select some type of bar which gives the minimum of trouble

* Read at a meeting of the Newcastle Branch of the British Foundrymen's Association, Jan. 25, 1919, Mr. J. D. Carmichael in the Chair.

to make and test. Such a bar is the American tapered pattern.

Testbars from Crucible Iron.—It is not uncommon to find that practical men dislike results obtained from cast iron which has not been through the cupola. What may have originated in prejudice appears to be justified by modern research. The equilibrium, if one may use the word in this sense, of molten metal after the many adventures of the cupola and ladle, is disturbed—so disturbed that it exhibits peculiarities

FIG. 5.—MAGNIFIED 27 DIAMETERS; REDUCED TO 21 DIAMETERS IN REPRODUCTION.

FIG. 6.—MAGNIFIED 110 DIAMETERS; REDUCED TO 88 DIAMETERS IN REPRODUCTION.

FIG. 7.—MAGNIFIED 110 DIAMETERS; REDUCED TO 88 DIAMETERS IN REPRODUCTION.

which we are not yet entirely able to explain; whereas the case of pig-iron melted in a crucible falls into a rather different category. Results from each method of melting are most valuable, but the author would not like to say that they were, in the foundryman's sense, comparable.

Suggestion as to Casting Bars.—When trying to produce two testbars giving equal tests, the foundryman is putting his knowledge and skill

FIG. 8.

FIG. 9.

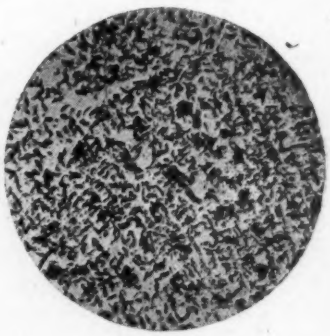

FIG. 10.

MAGNIFIED 27 DIAMETERS; REDUCED TO 21 DIAMETERS IN REPRODUCTION.

against some of Nature's most delicate ramifications. The author's experience leads him to believe that each bar should be cast in a separate box. The difficulties of obtaining the same metal poured under the same conditions may be overcome by the adoption of a series of boxes, gated from one common pouring basin, each gate being under control. Fig. 2 shows such an apparatus

Some method similar to this would allow of multiplication of tests under controllable conditions. For instance, the enthusiastic foundryman could ascertain the effects of (1) temperature of pouring, (2) rate of pouring, (3) height and size of "head," (4) different methods of "gitting," (5) thickness, density, and nature of the moulding material, (6) size and shape of testbar as cast, (7) attaching testbar to another casting, (8) various positions and ways of attaching it, (9) alterations in the dimensions of the other casting, and so on. Indeed, the author suggests that there is good work to be done in the iron foundry without the use of complicated apparatus.

Moulding and Machining of Testbars.—The results of many cast-iron testbars are rendered valueless by reason of moulding and machining faults. The metal adapts itself not at all, and every defect, however infinitesimal, lowers the final result. Figs. 3 and 4 depict in an exaggerated form some of the faults which, or variations of which, occur more often than the casual observer of tests appears to be aware.

A new method of making testbars, so that the accurate casting-centres are indicated for the guidance of the mechanic and also for the detection of a bad bar, is to be desired. Of course, many machine shops put their least-skilled mechanic and worst machine on to testbars, in which circumstances it is of no value to continue the work.

Handling of Testbars.—It has been proved that testbars which have been "rumbled" give higher results than those which have not, and by some writers it has been attributed to the release of strains set up between two bars cast in one box. The author frequently receives pairs of bars from a works some two hours' journey away, which bars are each cast in a separate box, and by goods train take about twenty-four hours to get from the foundry to the testing machine. After observing some hundreds of these tests every year, the author has arrived at the opinion that the little journey improves the transverse strength of the bars by an appreciable amount. The foundryman should realise from things like these how delicately balanced are the internal affairs of a freshly-cast testbar or casting of ordinary grey iron.

Testing of Cast Iron.—It would seem likely that the impact test, and its various forms of application, will provide a better guide to the quality of cast iron than the static tests hitherto employed.

Composition.—One sometimes meets with bars of very similar composition giving widely different results. This is the case with the two pairs of tapered bars chosen to illustrate this point. Both pairs were cast at the same foundry upon different dates. The mixtures from which they were produced gave other bars which did not differ greatly, and the mixtures are not very dissimilar and are shown in Table I. Repeat tests and analyses of the bars are given in Table II.

TABLE I.

	Strong.	Weak.
Cleveland pig iron	3	5
Middlesbrough hematite ...	3	2
Scotch pig-iron	1	1
Mild steel	1½	1
Cast iron scrap	11½	11
Mixture	20	20

TABLE II.

	Strong.	Weak.
Transverse test (1) ...	3 672 lbs.	2 878 lbs.
,, ,, (2) ...	3,672 ,,	2,798 ,,
Average	3,672 ,,	2 838 ,,
Brinell hardness number ...	23	207 217
Sclerescope	37 38	33-36
Combined carbon	0.61	0.75
Graphitic ,, ...	.59	2.6
Silicon	1 94	1.97
Phosphorus	1 15	.07
Sulphur	0 114	0. 8
Manganese	0.48	0.46

It will be observed that the difference in the transverse strength is over 800 lbs., while the difference in composition is confined to the carbon, both graphitic and combined carbon being 0.1 per cent. higher in the weak bar than in the strong one.

The experience of the author is that the difference in the physical properties of these two bars cannot by any means be entirely attributed to the above differences in composition. Although we do know that a particular form of graphite has very great influence upon the strength of the metal, there are cases, and this case is one, where by bringing forward a number of other results the author could prove that according to its composition the weak bar should be a strong one, but that would be based upon analytical results regardless of other facts, and the proof would be worthless.

Cooling of Cast Iron.—Before entering further into this question it is necessary to learn what happens when molten cast iron cools (Fig. 17, page 156). Cast iron commences to go solid when it has cooled to about 1,130 deg. C., and dropped into water at this point it will be white, showing that practically all the carbon is in combination with the iron at this temperature. A few degrees below this point the combined carbon begins to free itself, with the result that heat is given out, the cooling of the iron is arrested, the metal expands, and large scales or plates of graphite are formed in the semi-solid iron. It must be particularly observed that *time* is an important factor, and that if the iron of one testbar spends a second or so longer in this critical stage it will be different to the iron of another testbar spending less time there. This remark applies to each of the three critical points occurring in the cooling of cast iron.

At about 940 deg. C. the iron goes completely solid, but the graphite still continues to be formed right down to another critical point at about 700 deg. C. One would expect that that graphite, having the advantage of growing in the semi-solid metal at high temperatures, would be different to that which has to grow in solid iron at lower temperatures. This is very much what does happen, and we find that the first or primary graphite is thick and long, while the last or secondary graphite, not having the same

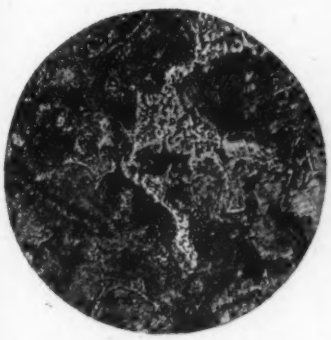

FIG. 11.—MAGNIFIED 300 DIAMETERS; REDUCED TO 240 DIAMETERS IN REPRODUCTION.

FIG. 12.—MAGNIFIED 430 DIAMETERS; REDUCED TO 350 DIAMETERS IN REPRODUCTION.

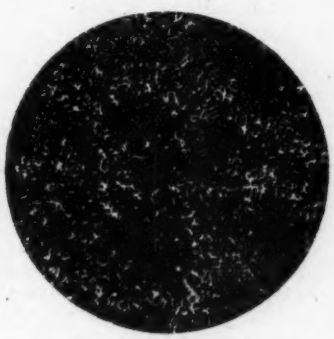

FIG. 13.—MAGNIFIED 27 DIAMETERS; REDUCED TO 21 DIAMETERS IN REPRODUCTION.

chance of thriving in its solid environment, is in small and fine condition, just as if it had had the greatest difficulty in finding a place for itself. The first and large graphite is curved and bent by, and round, the iron crystals; consequently it is a source of weakness, and cracks in the metal may sometimes be found to follow the cleavage planes caused by the interstices filled by, and formed by, the graphite plates.

Graphite.—Graphite being one of the most important things in the study of testbars and other castings, something may be gained by seeing the curious forms which it takes. The foundryman should get some clear conception as to why and when it is formed, and what it is like. Fig. 5 is the graphite in an ordinary No. 3 pig-iron. It is very large, very long, and very straight. Fig. 6 is that in a tapered testbar, and Fig. 7 that in another. Both are very different and confer different properties upon the metal.

Of the strong and weak bars shown in Table II., the graphite in the strong bar is shown in Fig. 8, while that of the weak bar is seen in Fig. 9. One sees that, in the case of the strong bar, the graphite possesses a distinct arrangement which is hardly perceptible in the weak bar. This is peculiar to strong iron, and is associated with the network structure of the phosphide eutectic, to be mentioned later.

The graphite in a strong semi-steel (so-called) shows the formation more distinctly, Fig. 10, and its graphite is more evenly distributed and more divided than in the other bars.

The structures in the strong and weak specimens and in the semi-steel are taken at the same magnification of 27 diameters, and from work of this nature one is led to suspect that much study of cast iron can be profitably conducted at magnifications under 100. Also, all the photographs, save that of the pig-iron, are of samples cut from the same position in tapered testbars of about 1.26 in. in diameter.

Phosphorus.—The phosphide causes another critical point in the cooling of cast iron at about 900 deg. C. This phosphide is molten after the main mass of the iron has gone quite solid, therefore it creeps about in the little spaces left between the crystals, and very often more of it gets caught in one place than in another, which is called segregation.

The still-liquid phosphide will be forced into blow-holes, with the result that we frequently find the hole filled or party filled by a globule which is harder than the surrounding metal.

Irons high in phosphorus and silicon form more graphite, are more fluid, and remain molten longer, wherein lies the explanation why so many castings of beautiful perfection are composed of low-class iron. The general tendency of foundrymen and engineers has been towards metal which most easily and perfectly fills a mould, which is iron of inferior quality for high-class work.

Fig. 11 shows the general structure of cast iron, and one sees the combined carbon as not very well defined pearlite, more or less segregated areas of phosphide here and there, and the whole cut up by graphite plates. Fig. 12 is an enlarged view of one of the phosphide areas, and one can easily imagine how it was left liquid, after the iron had solidified, and got squeezed about until it finally went solid wherever it happened to be at that temperature.

Coming back to the strong and weak bars of Table II. and the peculiar difference in the arrangement of their graphite (Figs. 8 and 9), there is found to be another allied difference in their phosphide arrangements. In the strong bar it has a definite network formation, shown in Fig. 13, with all, or nearly all, the graphite enclosed within its meshes. In the weak bar this is not the case, Fig. 14, and the phosphorus is irregularly distributed. The strong semi-steel, whose graphite is shown in Fig. 10, gives the network even more perfectly, Fig. 15; while the pig-iron, of the graphite shown in Fig. 5 shows no network at all, Fig. 16.

FIG. 14.

FIG. 15.

FIG. 16.

MAGNIFIED 27 DIAMETERS; REDUCED TO 21 DIAMETERS IN REPRODUCTION.

This paper being written with the sole object and desire that it should be of use to foundrymen, there is no excuse required for the more popular manner in which its subject has been approached.

The thoughtful foundryman should no longer remain in that state of mind which marvels when two testbars from the same ladle do not give the same result. Rather should he continually strive to discover and comprehend the laws by which such things are governed, and to attain that knowledge and that accuracy without which there can be no understanding and no progress.

In conclusion, the author wishes to express his sincere appreciation of the work of his head assistant, Mr. Gresty, in the preparation of the many slides and of the photographs.

Small Messrooms and Canteens.

Under the title "Messrooms and Canteens at Small Factories and Workshops," the Home Office have issued a useful pamphlet, illustrated by plans and photographs (H.M. Stationery Office, 3d. net), from which we reproduce the following particulars :—

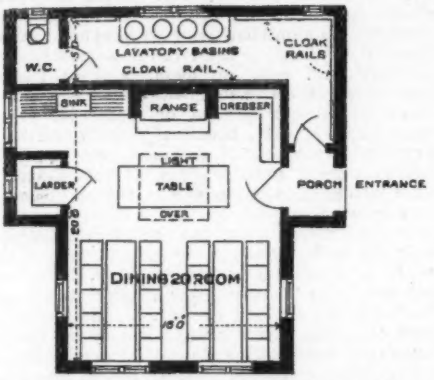

FIG. 1.—PLAN A. CANTEEN AND LAVATORY ACCOMMODATION FOR 20 FEMALES.

The provision of a messroom need not be an elaborate or expensive undertaking. A great deal can be done by the adaptation of existing rooms or buildings, and attractive and successful messrooms have often been provided in small factories on simple lines. The essentials of a messroom are a suitable and pleasant room set apart for the purpose and suitably furnished with sufficient tables and seats, and adequate means of cooking or heating food and boiling water. Whether it is desirable to go beyond this and to provide a canteen as well as a messroom, i.e., provide freshly cooked meals as well as a room in which to take meals, is a question which an occupier should always carefully consider. The arguments in favour of the canteen are that a hot meal freshly cooked is better than cold or warmed up food, and that the food can be supplied more cheaply. A good hot meal taken at the factory conduces to much better work, particularly during cold weather, and it is not much more trouble to cook a meal than to heat up miscellaneous dishes and basins of food brought by individual workers. A canteen is specially desirable if many of the workers live at a distance from the factory and are obliged to take two meals a day there.

An employer need not necessarily undertake the catering. He can—if that is thought the better course—provide cooking facilities, crockery and cutlery and leave it to the workers to do their own catering through the agency of a small committee of workers, or through the messroom attendant. Even if cooking facilities cannot be provided, soup, tea, coffee and other hot drinks can be prepared and sold in the messroom with little trouble, and are much appreciated. If, however, it is considered best to begin with a simple messroom, the possibility that it may develop into a canteen should be borne in mind from the start, and it will often be prudent to make allowance for such extension when settling the original plans. When a messroom or canteen is provided out of profits, Excess Profits Duty is not charged on the whole of the initial cost of the work. The Board of Inland Revenue in assessing the Duty make a special depreciation allowance equal to the difference between the initial cost of the accommodation and its estimated value after the war, so that the occupier will suffer no loss financially if he provides the accommodation now (although prices are high) instead of postponing the work until building and other costs are less. The exact amount of the depreciation allowance cannot, of course, be determined now, but the Board of Inland Revenue are willing in every case, if so desired, to make an approximate provisional allowance.

The first point to be determined is the number to be provided for, as everything else depends upon it, but it is often difficult to tell in advance how many of the workers are likely to make use of the accommodation, and a good margin should therefore be allowed. Personal inquiry among the workers will give the occupier the best means of forming an estimate. Allowance

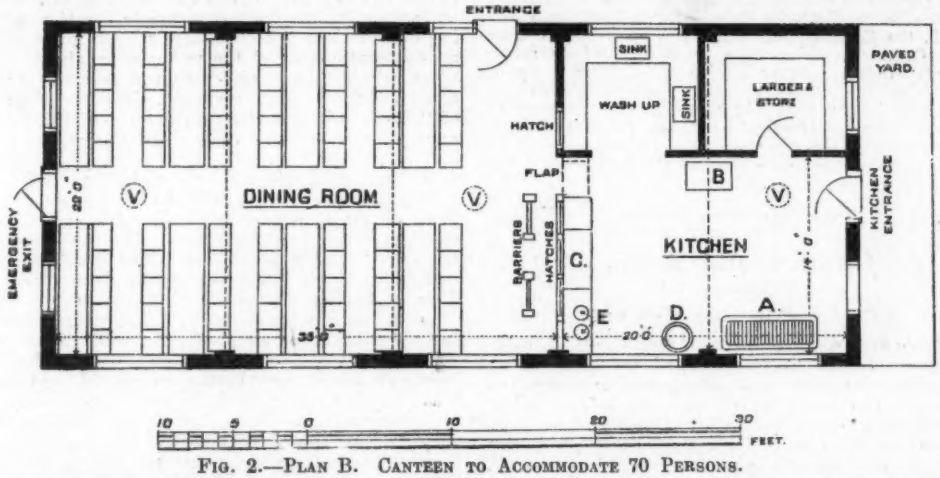

FIG. 2.—PLAN B. CANTEEN TO ACCOMMODATE 70 PERSONS.

A.—3-Oven Gas Range. B.—Hot Cupboard. C.—Hot Closet. D.—Water Boiler. E.—3-Gallon Urns. V.—Ventilators.

must be made for the fact that workers do not readily change their habits.

The second point to be determined is whether there is any room or covered space already available within the works which can be utilised for the purpose. This is the most convenient arrangement for small works, except where the character of the industry is such as to make it desirable that the messroom should be entirely separated from the working part of the factory. A messroom outside the factory premises, unless it prac-

tically adjoins the works, is subject to the disadvantage that the workpeople are exposed to discomfort in reaching it in bad weather. On the other hand, the shortage of building materials and labour at the present time may prevent the erection of a special room or building on the factory premises, and it may be necessary, if only as a temporary arrangement, to take and adapt some existing building.

The success of the messroom or canteen will largely depend on the design and arrangements. The room must be sufficiently spacious to prevent overcrowding; light, airy, warm (in cold weather) and pleasant in appearance. Means of washing before the meal add greatly to the value of a messroom and contribute materially towards its success.

Two plans are given with the memorandum, and are reproduced herewith. They are intended as specimens only. The conditions as to site, numbers to be provided for, and equipment, will be so various that the plans will usually need some adaptation to meet the circumstances.

Plan A shows a canteen suitable for about 20 people. The kitchen space forms part of the dining-room, and provision is made for washing basins, cloak rails, a single w.c., and a small larder.

Plan B shows a canteen to accommodate 70 people. In this building, washing facilities and a cloakroom are not provided for—not because they are not necessary, but in order that the plan may serve as a guide for works where they are already provided apart from the canteen. According to the pamphlet it should be practicable to erect buildings of a simple character, even under the existing exceptional conditions, for about 6d. per cub. ft. (exclusive of costs of central heating and lighting).

The rest of the pamphlet gives useful hints about the equipment of the messroom and the kitchen, about details of construction and equipment of lavatories, etc., the management and maintenance of messrooms and canteens, and about attendants.

An appendix contains a reminder that under Section 7 of the Police, Factories (Miscellaneous Provisions) Act. 1916, the Secretary of State is empowered to issue an Order requiring the provision of arrangements for preparing or heating and taking meals, of facilities for washing, and of accommodation for clothing, in any cases where such provision appears to be necessary for securing the welfare of the workers. It also quotes the requirements contained in the Welfare Orders made under this section in respect of certain industries.

Queries and Replies.

Cost of Producing Castings.

Reply.—In pricing for the production of castings in green sand, dry sand, or loam in a jobbing foundry, one must get an approximate cost of wages in the lump, pig-metal, coke, and all other furnishings connected with jobbing founding. These, together with rent, rates, and profit per cwt., cover most of the points essential to successful quoting. But perhaps the greatest difficulties to master in this sort of work is foundry capacity, equipment, and methods; for while one jobbing foundry plant may determine a certain *modus operandi*, another would move in an opposite direction and thus be able to reduce cost of production to an extent impossible with other competitors. Consequently, in many cases it has been found by experience better to cast plant suitable instead of "faking" plant from whatever one may be able to find or to pick up from the miscellaneous scrap-like plant lying about most jobbing foundries. Of course, experience has got to look at things in this sort of work both ways and determine accordingly.

The ramifications in pricing for a foundry, and more especially as it applies to jobbing work, make it more than impossible in the form of query and answer to do justice to the subject: to wit, the cost of pattern, etc., all of which must be included in the cost of any given casting, large or small. This admitted, it often happens that much that is moulded in sand could be much cheaper moulded and cast in loam, and to the great advantage of all concerned. Obviously, the cost of storage and insurance of patterns, whenever loam work is cast, becomes a myth when compared with the cost of patterns used in moulding and casting of sand castings of any description. This being so, the wonder is that much that is cast in sand in jobbing lines is not done in loam, especially where only one or two castings of weighty and elaborate design, it may be, are wanted. Needless to say, sand v. loam moulding will always have their limitations; hence it is that every jobbing casting, large or small, can only be considered for what it may be worth for intending competitive founders; and the more experience the person quoting has of the actualities of output in a jobbing foundry the more will his chances of successful pricing be increased.—W. R.

Swampy Foundry Floor.

Reply.—Assuming the swampiness of the ground for proposed foundry to be caused by the flow ot surface water, perhaps due to imperfect drainage or hollowness of surface situation—probably both—the better way, in my opinion, would be to cut the flow of water by a suitable drain right round the foundry; depth and other details must be largely left to those responsible for the carrying out of the work successfully. Drainage, with an automatic flow of the water complained of to some suitable place, either to run to waste or be conserved for a foundry supply, should be the aim of "I. E. S." in seeking to get rid of this nuisance. As I do not favour open drains, such as fireclay or concrete pipes, in immediate touch with a foundry, perhaps a sort of rubble material or strong burnt coke would be preferable, thus avoiding the generation of gases and the possibility of an explosion in consequence. The tar-macadam suggested in the query intensifies this danger, especially where heavy casting or drying in the floor might be resorted to.

Again, if this nuisance of water arise from springs within the walls of the foundry, and the class of work be floor-drying, either in dry sand or loam, it might suit better to mould and cast heavy work as suggested, in watertight cast-iron tanks or casings. These for repeat heavy work, with permanent adjuncts cast in for binding, and in some cases, if need be, binders underneath for the same purpose, might be the safest and cheapest to cast work that is moulded and dried in the floor of swampy and damp foundries, such as the query in question suggests. Lastly, there is still the other way, i.e., mould and cast in top and bottom boxes, if suitable for the work intended to be done. And if this be not quite good for "I. E. S." to get out of his difficulties, then my advice to him is to look for ground more suitable for a foundry for his requirements, and where explosions from damp of any kind, with ordinary care, are not likely ever to become abnormal.—W. R.

British Foundrymen's Association.

BIRMINGHAM BRANCH.

Plaster Patterns.

At a meeting of the Birmingham Branch of the British Foundrymen's Association, on December 7, 1918, Mr. J. J. Howell (President) in the chair, a paper was read by Mr. C. Robinson on "Plaster Patterns in an Engineering Shop."

Mr. Robinson said he purposed to give as briefly, as clearly, and in as practical a way as possible, an account of some of the patterns made in an engineering shop. It was said when Mr. Heggie gave a paper on this subject about four years ago, "Oh, yes, these thin and little patterns are all right, but when you get to big ones, it does not pay to set up such patterns in plaster." That was not quite correct, but the best answer would be to give some examples of patterns actually produced in the engineering line. To commence at the beginning, he would deal with the mixing of plaster-of-Paris. This was an all-important matter, as it decided to a great extent the success of plaster patterns. Various methods had from time to time been given, but none seemed to altogether agree with the facts he had learned from experience.

Taking first the receptacle in which the plaster is to be mixed, and putting in the requisite amount of water, the plaster should be added gently, till it is well saturated, and the plaster has a tendency to float on top of the water. This should stand a few minutes, so as to get the plaster thoroughly saturated, and it will be found upon stirring that the plaster mixes quite smoothly. It is a mistake to put in plaster with one hand and stir with the other. In that case the plaster will be lumpy unless it is exceedingly well mixed. With this knowledge of mixing plaster one can start at least on such patterns as core boxes, chills, or dies. With all such patterns plaster effects a great saving. The illustration Fig. 1 shows the die of a small cover:—

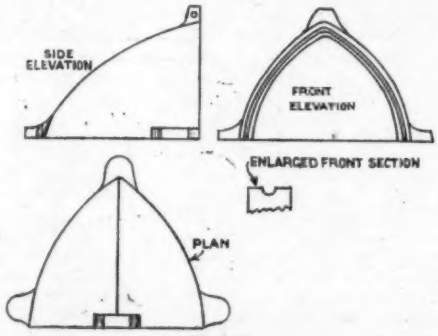

FIG. 1.

The pattern should be laid on a board, and first of all a plug should be made to suit the inside of the cover, taking the groove on the end and also forming a shoulder. A rough box being made, the plaster should then be poured in.

The plug and pattern should be laid on the board and the box placed round, after which the plaster should be run on.

Fig. 3 shows the pattern and plug ready for plaster. This is now turned over, the surface varnished and greased, and the top part run on in two parts with runner sectioned in each half. The plug gives the thickness of metal, the lower half the outside shape, the top half the runner and pattern with bead, enabling the cover to be cast at small cost, with unskilled labour, and grooved without the cost of machinery.

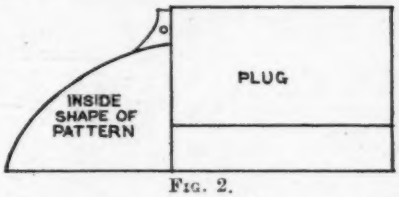

FIG. 2.

In the case of core boxes and dies some difficulty is found in taking the pattern off the plaster. It is generally done by rapping, which, however, is harmful to the pattern; it also chips and often breaks the plaster. This can be overcome by the arrangement shown in Fig. 4.

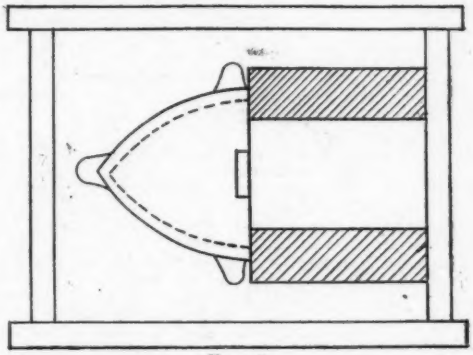

FIG. 3.

This sketch represents a square block in plaster. Two pieces of wood should be placed on either side of the box, and then a piece should be placed along the top with a screw. By screwing into the pattern it is found that the screw pulls out the pattern.

Mr. Robinson next dealt with an example of the circular pattern, namely, a turbine segment, 60 deg.

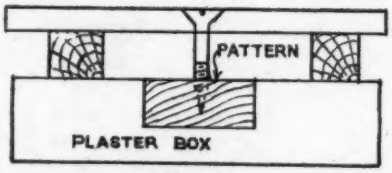

FIG. 4.

Plaster, he explained, is very useful in circular work, as patterns can be run up without the expense of a lathe. In some shops the lathe will only take a small size, and in such cases the plaster is the only means of doing the job to advantage. All that is required is a centre, and this is not an elaborate arrangement, being only a piece of, say, ½ in. steel, 6 in. long, with a pin turned on as per sketch and taken down to half diameter. There should be a small circular plate to receive the pin (Fig. 5).

He had always found it best first to lay out the

pattern on the board with all the degrees for the holes. In a pattern of this size, it would not do to use all plaster, as obviously a tremendous amount would be required. The proper course, therefore, is to block it up—in other words, to make a staging and cover it with laths, leaving these as rough as possible to make the plaster adhere, and so keep a little space between all of them for the

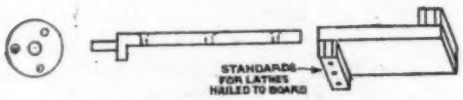

FIG. 5.

plaster to get a good grip, on precisely the same principle as used by the plasterer for the ceilings of houses, etc.

Fig. 6 shows the strickle ready to proceed with the running up of the block, with the centre fixed, and the runner, which should be no less than 12 in. long to get a good firm basis on which to work. In running up a pattern of this kind it is necessary to have the centre standing out of the board, otherwise the board would have to be of very large dimensions.

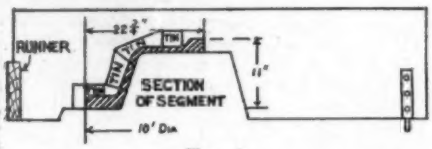

FIG. 6.

In a pattern of this description the plaster in the block gets pretty well hard, and commences to swell, so that it is best to keep it just below the strickle till it is all practically up; then a bucket of plaster will finish the job and so do away with the trouble of cutting off the hard surface. The strickle is protected on the surface by pieces of tin, as shown in the sketch. This is now run up, and then the strickle is cut to the outside line of the pattern, and the block is varnished and greased. For this operation tallow is best, as oil is likely to

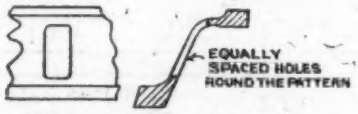

FIG. 7.

run down the surface, with the result that instead of having a nice sharp corner on the bottom, the oil causes a fillet and small blowholes.

After this is done, the operator is now ready to run the thickness of pattern. This is the most difficult part of the operation, as this being only a thin piece of plaster, it sets sooner, and, therefore, swells quicker, so speed is required to make the operation successful. After this is run up, the lines are squared up off the board into the plaster, and the holes are cut out, boss placed on and varnished, and the pattern and board complete go to the foundry to be cast.

The gear cover next dealt with illustrates how an irregular shape can easily and quickly be put together. (See Fig. 8.)

For convenience the parts are lettered A, B, C, D. A and B are run up in one length, C and D are run up in their respective positions on the board, then A and B are cut to suit parts made up, and the middle strickled out in the mould.

Fig. 9 shows a gear cover made on the principle of guide work. To make the pattern a strickle is made with a runner at either end. These are run in between two strips of wood to guide them in a

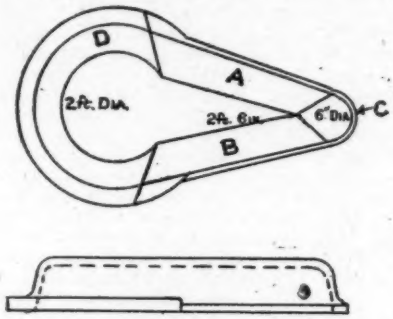

FIG. 8.

straight line; outside these strips are two plates set to the level, so that all that is necessary is to run the strickle to form the section of pattern, and also strickle off the bevel by running a straight-edge down the outside guide strips.

These few examples, Mr. Robinson remarked, showed the enormous saving of time and timber effected by plaster patterns, while there was no doubt that a more regular and perfect casting could be made from the plaster than by the use of block pattern and core box.

Replying to questions, the author said the ques-

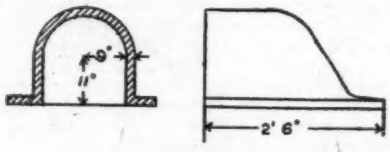

FIG. 9.

tion of determining the quality and quantity of plaster depended on experience. As to the kind of cement, they would find Keene's cement quite satisfactory, giving a good sound pattern. He sometimes used lime, but he found that while it extended the time, it destroyed the plaster. He did not like it, but when he used it he put it to slack in a separate vessel, and then poured off the water. The disadvantage about it was that it never set as hard, and was always crumbling, and it would have that effect on the plaster if excessively used. Keene's cement could give a harder job if mixed with plaster.

SCOTTISH BRANCH.

At a meeting of the Scottish Branch on February 8 (Mr. R. R. McGowan in the chair), Mr. A. Campion, F.I.C., F.C.S., delivered a lecture on "Additional Notes on the Influence of Some Constituents on Cast Iron." The lecturer at the outset stated that the object of his researches on

the influence of some special constituents on cast iron was to try and find that alloy which would show the least sign of growth after being heated intermittently.

The progress of development in the engineering industry now demanded properties in cast iron often difficult to obtain. Take, for example, the cylinders for internal combustion engines. The metal for such castings must be able to give effective working results when the metal is raised to a fairly high temperature.

The lecturer stated that he had carried through a considerable number of experiments in order to find the effect of adding to cast iron a definite amount of nickel, chromium, molybdenum, tungsten, boron, vanadium, titanium, and manganese. These constituents were introduced as ferro-alloys and added to the bottom of the ladle before it was charged with the metal. The pig-iron selected was of a quality considered most suitable for work such as the cylinders for internal combustion engines. Such castings compelled the selection of an iron low in graphitic carbon because of the fact that iron high in graphite increases in volume on reheating. For the same reason the silicon content of the iron was also low, being 1.5 per cent., and the manganese content was 0.5 per cent., the total carbon being 3.4 per cent.

The castings were subjected intermittently to a temperature of 450 deg. Centigrade for periods of four hours each. They were accurately measured at the end of each heat when they had reached normal temperature, and the result tabulated in the form of a graph. In every case the results showed that the metal went through some remarkable changes, especially during the first six heats. In some cases a marked increase and in others a decided decrease in volume was recorded; after the sixth heat, however, most of the examples remained fairly stationary. The conclusion arrived at from the experiments was that the most critical period for any casting subjected to intermittent heats was at the initial stages of the tests. In every case, however, the addition of the special constituent increased the strength of the iron.

The transverse strength of the original iron without any admixture was 2,136 lbs. on a bar 1 in. sq. in section on supports 12 in. apart, and the tensile strength was 13.5 tons per sq. in.

The following table shows the comparative results:—

	Transverse strength in lbs. on a bar 1 in. by 1 in. on 12 in. centres.	Tensile strength in tons per square in h.
Metal without admixture ..	2,136	13.5
With an addition of 1 per cent. of:		
Chromium	2,332	16.05
Nickel	2,650	14.75
Boron	2,550	14.5
Tungsten	2,650	16.6
Molybdenum	2,730	17.6
Manganese	2,360	14.25

The experiments also embraced the recording of the effect which the reheating of the metal had on the strength of the different alloys.

The lecture was illustrated by a number of lantern slides containing graphs of the various results recorded. An interesting discussion followed, and a vote of thanks to the lecturer terminated the meeting.

NEWCASTLE BRANCH.

A meeting of the Newcastle Branch of the Association was held in the Mining Institute, Newcastle, on February 22, when Mr. M. E. Gallon, of Dunston-on-Tyne, read an interesting and informative paper on "Moulding a Large Crown Bevel Spur Wheen without a Pattern." Mr. J. D. Carmichael, the President, occupied the chair, and there was a good attendance. The paper will be dealt with in our next issue.

BIRMINGHAM BRANCH.

Visit to Coventry.

On Saturday, February 22, the members of the Birmingham Branch of the British Foundrymen's Association, to the number of about 60, paid a visit to Coventry, for the dual purpose of inspecting the Siddeley-Deasey Aircraft Works and subsequently listening to a lecture by Lieut. E. A. Bush, R.A.F., on "The Foundry Service from an Engineer's Point of View."

About two hours were spent in a tour of the factory. The Siddeley-Deasey Works has undergone enormous expansion during the war, owing to the fact that they were in a position to turn over, wholly, to aircraft production on a very large scale. Nearly 1,000 aeroplanes were turned out during the war, and though production, since the signing of the armistice, has been somewhat curtailed, a large output of machines is still maintained. The works occupy a site of about 22 acres near the London and North-Western Railway, and the entire establishment comprises a group of shops of gigantic dimensions. The visitors were received by Mr. H. Moore, Chief Inspector, who had with him an ample staff of foremen and other officials, who were able to divide the party into small sections, each of which made a tour of the works. This enabled detailed explanations to be given of all the mechanical operations. The works are laid out on the most modern lines to facilitate continuous and speedy progress of machine parts through the shops. The heating is by means of hot air, and purity of atmosphere is secured by a suction system which not only abstracts all undesirable fumes, but absorbs dust particles, conveying them to the outer air. Fullest use is made of capstan and turret lathes of the latest type for boring, turning, drilling, grinding, polishing, etc.

During the war the firm employed nearly 8,000 workpeople, now reduced to about 5,000. The interior organisation and the continuity of the operation ensure a large output. All the parts have to be strictly to weight and measurement, and are subjected to the severest tests both before and after their inclusion in the machines.

At the conclusion of the visit a hearty vote of thanks was proposed by Mr. Andrew Harley to the Siddeley-Deasey Company and to the members of the staff for arranging and organising the visit.

SHEFFIELD BRANCH.

Electric Welding.

At a meeting of the Sheffield and District Branch on January 24, when Dr. Hatfield presided,

Engineer Lieut.-Commander Jackson, R.N., read a paper on "Welding," which he read before the Lancashire Branch at Manchester on November 2, 1918, and a report of which appeared in a previous issue of this Journal.

THE CHAIRMAN, at the conclusion of the lecture, said that on an average number of tests the efficiency as regards the strength of a weld as compared with the good portion of the casting, it had been found that the weld was from 60 to 70 per cent. That was a fact they should keep before them. In steel castings and in steel generally the weld was, according to the finding of his investigation, a strength of 60 to 70 per cent. of the original casting, which was not so good as if there was no weld. Therefore, they did not want a single weld if they could do without it; though in their own works they sometimes found it extremely satisfactory. No one, however, should weld a casting without first putting it before the works manager. He thought that if the idea once got into practice through the foundries, that welded castings were quite as good as sound castings, there would be a tendency to do slipshod work. As regards welding, from his own experience, he considered it an art. If a man attempted to weld and had no previous experience, particularly of modern methods, he would only make a mess of things. He would like to see the trade or craft thoroughly investigate the process. He would like to investigate and test the claims that had been put forward on behalf of the American officers who had repaired the vessels that Commander Jackson had spoken of, namely, that the steel welds were quite as strong as those not broken. His explanation of the fact that these vessels were able to come across the Atlantic and do the useful work they did was that the engineer who designed those parts allowed himself a factor of safety of one to four or five, or even one to seven. Under the stress of war they might attempt welds in such a manner, but he was convinced that in none of their large Sheffield works would they permit them in times of peace. They might attempt welds in times of a national need or a national emergency which they would not tolerate in peace.

ENGINEER CAPTAIN MARK RUNDLE, D.S.O., said he thought moulders would be very glad if they could find something that would help them out of a difficulty, and, no doubt, electric welding had done that. If the system were used, however, it should be used with considerable restrictions. Welding should only be undertaken after full consideration of all the circumstances. At the same time, there was considerable room for improvements on welding, as they knew it at present. With steel castings, particularly, it was necessary to get the best system tried. Experience was necessary, but they should also have first knowledge of the use of fundamental materials. They should start with easy things and work up to more complicated ones. A large steam valve had come under his supervision. It was a very interesting casting, and it had given a good deal of trouble. After consideration they decided to electrically weld it, and the results had proved that the welding was done satisfactorily. They tested it in every way they could think of, and took into consideration the uses it was going to be put to, and it stood the tests satisfactorily.

MR. PEARSON said welding was essentially an art, and not fool-proof, and mistakes would occur. The welder should practise to such a pitch that it was more difficult to make a mistake than to do the thing properly. With the electrode the difficulty was with the slag. He did not know if it were possible to have less slag, because they must have a covering for the steel. But if the slag got into the cavity it was almost impossible to get it out. If any of them were undertaking the work he would advise them to practise on scrap steel—put the run all the way round and see that it was kept clear of the slag and then join the next layer up to it. It was a most difficult matter to keep the slag away from each layer. They should first run over a very fine surface. It was also necessary at times to open out the casting wide enough to get the electrode into it. A great point also was to see that the angle was the same on both sides. At their works they had done some important tests with Commander Jackson which were not satisfactory. Some were good and some were bad. The Quasi Arc Company were good enough to take the matter up with Commander Jackson, and they pointed out to him that the method was all right, but that it was the operator's experience that was at fault. After further trials they had some more tests, and the worst then gave them 84.4 per cent. the original strength, which was pretty good.

MR. T. BROWN remarked that a lot had been said on the practical side of the question, but there was something else. He would like to ask why electric welding was not better known or more extensively practised? He knew that inspectors came forward with very inadequate weapons. They were sent forward with specifications, which, if strictly adhered to, would mean that no electric welding could be done, because it would not be allowed. It was only allowed in the ships that had been mentioned because of the stress of war. He doubted if they would be allowed to do it to-day. Owing to the war the specifications had been allowed to go by the board.

THE CHAIRMAN said he would like to point out that everything that had been done on these ships had been done under inspectors. He did not want the idea to go abroad that the specifications had been thrown aside altogether.

MR. BROWN said that his idea was that the inspector was the man who should be applied to before welding was done, because he was the man who knew what the requirements of the casting were. He knew its purposes and should have liberty to say if welding might be done.

MR. J. R. HYDE said he thought they had rather got to regard the subject of welding as applied merely to defective castings. It seemed to him that they had forgotten to look at the new developments that had now taken place, and which had made possible the joining of plates, and which had reached their latest masterpiece in the development of shipbuilding. They had seen the successful welding of the bands on tyres of motor vehicles. Hundreds of tons of these things had been satisfactorily done by the electric welding system and many other things brought into prominence by the war had been welded by the electric welding and oxy-acetylene system. Their attention had not been directed to the constructional uses of electric welding; but they had seen the emergency uses which had proved the value of the art, but in a manner which the outside world thought were only made necessary by the shortcomings of moulders. With regard to the discrepancy between the stated test of 60 per cent. and the statement that it was possible to get 84 per cent., it seemed to him that the strength of the original piece, compared with the welding material, which was mild steel, had something to do with it. Possibly the original piece may have contained 0.4 per cent. carbon, and in that case 38 or 40 tons would be the tensile strength. The welding material tensile strength was 22 possibly. If they had a perfect weld of

steel of 22 tons and they compared it with the original steel of 38 tons, which was a fairly low figure, even if they had got a perfect weld, they had only a maximum of 65. Let them take a mild steel casting, with which the inspector is satisfied if it gives 26 to 27 tons. If they put in a thin layer of mild steel and got a perfect weld of 22 tons, they got something approaching 80 per cent. If the lecturer or Dr. Hatfield thought that idea satisfactory, he would be glad to know. There were things they did not see which might reduce the strength down to 60 per cent., as well as the little cracks they did see.

Mr. F. Darley recalled that some years ago a foreman of theirs made extensive experiments in welding on a process of his own. It was steel without being covered by the slag, and by that process on nickel steel he got somewhere about 70 per cent. of the maximum; and in some cases he actually welded with the same material as the steel itself and had it forged out. He had often found, when the material was of the same analysis, that after welding the carbon was reduced considerably. He considered that in intricate castings it should be annealed, because, in his opinion, annealing was the best test for electric welding. If it was a good job it would stand the test of annealing, and if it was not a good job it would not stand it, for the reason that stress would be set up all round the weld with local heating, and when the mass was heated other stresses were set up. If it was a good job it would stand it.

Mr. C. Pollard said they seemed to have lost sight of the fact that the main point in the whole thing was the electric power. It was very important that the welder should understand the amount of power he was to use, taking into consideration the strength and thickness. It would not do to have too much or too little. That was so especially in Quasi Arc welding. They should bring the power in relation with the electrode; otherwise there would be a disturbing of the slag; they would not get an even flow and the weld would be spoiled. They should teach their welders how to do that, if they were to get a good weld.

Mr. B. Foxley said he would like to hear an opinion on welding he had seen, where the difficulty was keeping the slag out, because the temperature was not right and the slag would flow. Acetylene had the advantage over electric welding because they had only the flame, and the weld could be made almost as strong as any part. With regard to Thermit welding, 92 to 95 per cent. of the welds in Germany were Thermit welds. In cases where it was not necessary to machine, they could add on very considerable strength, because it was not necessary to plane off.

Mr. Kayser asked if any gentlemen present could give any information, or if they had any experience of welding nickel steels and other alloys containing nickel. He had found it very difficult. He had sent half a dozen specimens, and they only got one suitable weld. He had been advised to use a bigger blow-pipe than was used for steel of the same size and use any flux which would cover the metal, such as borax or powdered glass. For such alloys the Quasi Arc was not much use. It was very essential that they should use the same material.

The Chairman said they used the oxy-acetylene all right with borax flux. If the job were large enough they pre-heated and got a size larger blow-pipe. They tried to keep as much flux as possible on the work. Looked at through the microscope it was quite all right and planed well. Cast-iron did not weld well on cast-iron, but with a little steel interposed they could get a good weld. He would like to know if any of them had any experience of that.

The Chairman said that looking at the Thermit and acetylene processes as alternative to electric welding, it should be borne in mind that the Thermit process depended upon chemical reaction between the aluminum and the oxide of iron. The aluminium combined with the oxygen and the iron and tremendous heat was evolved, the iron being liberated at an extremely high temperature—at a temperature which was really astonishing. The result was that in the weld there was a little bowl of very superheated metal, and personally he would look with disfavour on that. Mr. Hyde made a very important contribution, in which he pointed out that the mechanical property of the weld was entirely dependent upon the properties of the material used, as in the Thermal process, it had a tensile strength which certainly did not exceed 20 tons. It was quite a practical method, and in welding wheels and that sort of thing had proved a great success. With the acetylene method, if one got a reducing flame, the acetylene actually carbonised the weld, and he had seen a micrograph in which the whole weld consisted of pearlite and was not tough. He quite agreed that the electric system was the best available at the present time for this work.

Commander Jackson, in reply, sympathised with Mr. Brown's complaints about inspectors, but at the same time inspectors had a duty to perform, and they knew that sometimes castings did go wrong. Some, like himself, who had been to sea, had had experience of defective castings and breakdowns of various kinds, and they knew a little about what it meant to men who had to make good the defects. As inspectors they had to see that what was passed was likely to prove efficient in service, and he knew that all the manufacturers in Sheffield district quite agreed with that view. In reply to Mr. Hyde he would like to say that the steel used was 0.3 per cent. carbon giving about 30 tons tensile strength. He agreed with Mr. Barley as to improved percentages and efficiency being obtained by operators as they got more experience and also better appliances. The tests were made in a rather rough and ready manner. The resistances that would be used in ordinary conditions were used in this instance. With regard to using oxy-acetylene in repairing of the German ships, it should be borne in mind that they would have to be taken out of the ship and put in a horizontal position, causing a great deal more work than if the electric arc sysetm was used. The Thermit process was very useful for repairing parts of ships where there was plenty of room for adding as much material as one liked to put on. All the systems had their own special advantages, and it depended upon the circumstances in which they were going to work which they would use. If they wanted to repair the job in its position they would use the electric arc. In reply to Mr. Kayser, he had to say he had no experience of nickel steels, but he had seen it done successfully in some of the works where nickel steel was used for armour-plate. On the question of using electrical welding constructionally, it was a very large question, bigger than he was disposed to deal with at the moment. It was, of course, used, and that method with low-pressure resistance, the Thompson process, was used very extensively throughout the country in repetition work.

LANCASHIRE BRANCH.

The Foundry Lad.

At the meeting of the Lancashire Branch on February 1, Mr. S. Roe in the chair, an address was delivered by Mr. G. P. Howden, principal of the Openshaw Technical School, upon "Defects in the Treatment of the Foundry Lad: Suggested Causes and a Remedy." He said it was his duty each week to come in contact with the students at four apprentice day courses, and with hundreds of evening students, all drawn from engineering works, and he could not help being struck by the contrast between the types of youths attracted to the various departments in those works. He had extracted from the school records the following figures, showing, in the first column, the percentage of the total number in the school who came from the various departments, and in the remaining columns the character of the education which they previously received. All the figures were percentages:—

Department.	Percentage in schoo'.	Previous education. Secondary.	Public or grammar.	Elementary.
Drawing office	16.66	50	4	46
Fitting department	30.00	51	6	43
Turning	26.00	42	5	51
Pattern making ...	0.60	18	0	82
Smithy	0.25	100	0	0
Foundry	7.50	9	0	91
Machine shop	14.00	26	3	71

The explanation of the figures with regard to the smithy was that out of 250 students only one came from the smithy, and he had received some secondary education previously.

This was a school which encouraged foundry boys by running a special course for them. Through the kindess of the principals of six other branch technical schools, he had obtained the percentages such lads who attended there. The percentages were 0.75, 1.3, 0, 2.3, 1.8, 2.1. In the higher classes the proportion was even smaller, so that the contrast appreciably increased with the years. The obvious conclusions to be drawn were one or other of these:—

1. The lads are intellectually inferior.
2. The courses are not suitable.
3. The character of their daily work and the officers whom they serve exercise neither inducement nor pressure.

Possibly all three were true.

Assuming the accuracy of the first conclusion, the question arose, why did the foundry attract a lower type of boy? He had visited various foundries and was told by the managers that the greatest opposition to a boy entering their employment came from the mothers. It was said it was a dirty job. But was that the only reason? He had laid before several managers a new scheme for an apprentice course for the lads, and was given every encouragement; but the actual results were disappointing. Taking three of the largest works, from one of them only two boys came, and that was for a time only. The manager at another establishment said, "We have plenty of rammers, but no foundry lads." In a third case it was found that none of the boys was sufficiently educated to take advantage of the opportunity. The scheme was that the foundry management should select five boys and pay them their wages for the day. Sometimes they paid the school fees, and in one case found the books.

He thought it must be admitted that the other two conclusions were also justified. There was in England not a single example of apprentice day training, and almost no evening courses specially designed for foundry lads. Openshaw was an isolated case. Of course, he did not mean that there were no such courses of study in a college like that in Manchester, but they started much further up the scale, and did not cover the field he was now examining. Contrast this with the state of things in the much bombed town of Saarbrucken. There, in 1908, three schools for foundry lads were all full, and were attended by them on one day in each week. Many other towns in the Saar and Briey basin could show a similar record. As to the training given in the foundry itself, his opinion was that it was as likely that it would make an efficient all-round foundrymen as that a one-armed fettler could be efficient. A boy might become a core-maker, a bevel moulder, a floor moulder, or a plate moulder, but that did not make him an efficient foundryman.

Foundry work was, indeed, as full of science as any branch of engineering, and could be made the basis of a liberal education. Take the use of levers in the strength testing of castings. What a large field of physics and mechanics it opened up to an intelligent mind. The use of manures as mixers might lead to the consideration of such subjects as viscosity and porosity. How difficult venting could be managed was another subject. The use of chills and denseners opened a way to such studies as the laws of cooling, hardening, specific heat, conductivity, etc.

Summarising the causes of the unsatisfactory state of things now existing, he put first the unattractiveness of foundry work, which limited the range of selection. Secondly, there was no special organised method of securing the education of those who did come into the foundry. He must mention, however, that admirable work was being done in the Manchester district and, he supposed, elsewhere, by supervisors who were appointed to look after the welfare of the boys. It was largely owing to their efforts that many boys no longer frequented the street corners, but entered the classes. With a hope of assisting in that excellent work, he put forward two suggestions. The first was that in the works opportunity for acquiring a wider experience should be given. The boy must not go on day after day ramming sand into a moulding box, with an absolutely deadening career in front of him; he should be trained in the different operations that were in progress. Then he would ask the Board of Education to provide suitable courses of instruction in the schools. What had been aimed at hitherto was to make the student a more efficient boy in the immediate future. Longer views must be taken, and the object should be to turn the boy into an able man.

The wider experience in the works might be planned as follows:—

Six months	Pattern stores and yard.
Three ,,	Stage.
Six ,,	Fettling.
Three ,,	Sand moulding.
Twelve ,,	Core shop.
Eight ,,	Plate and bevel moulding.
Remainder	Floor moulding.

Each boy should be allowed an experimental week or a fortnight, and he ought to have tuition in testing strengths.

(Discussion on the paper will appear in our next issue.)

Town-Gas Furnaces.

Heat losses in the furnace flues have always been a great objection to the use of town gas for firing case-hardening, annealing, billet-heating and similar classes of furnaces. The Davis Furnace Company are now exhibiting at their Diamond Foundry, Luton, a furnace fired on the new "Revergen" principle, which it is claimed utilises a much larger proportion of the total heat latent in the gas than has hitherto been possible. The earliest types of gas-fired furnaces were direct heated, more or less on the principle of the gas cooking oven. Their wastefulness, however, was palpable, and in due time led to the introduction of the natural-draft regenerative oven, the more usual types of which are provided with flues beneath the floor, through which the air for combustion passes on its way to the combustion chamber. These furnaces, though widely used, are not truly regenerative in action. The pre-heating of the air is accomplished, but is not achieved by heat which would otherwise be lost to the furnace, the hot gases leaving the hearth or muffle passing direct to the flue and being thereby lost. The escaping gases therefore leave the furnace at, or closely approximate to, the working temperature of the oven, the flue losses being correspondingly great. In this type of furnace the main economies effected are due, firstly, to the pre-heating of the secondary air, resulting in higher flame temperature and greater efficiency, and secondly to the limitation of the amount of air passing through the furnace to approximately that which is essential for the combustion of the gas consumed in firing.

In the Davis "Revergen" oven-furnace (Fig. 1) the heat-absorbing materials in the regenerator chambers are first heated by the escaping gases and are then cooled by the incoming air, as in the case of hot-blast stoves. Whilst one heat reservoir is cooled, the other is being heated by the escaping gases, thus reducing their temperature and retaining the heat until it is in turn taken up by the incoming air. The air is in this way heated on its way to the furnace, the inversion process resulting in the production of a higher flame temperature, with an accompanying increase of efficiency within the furnace, over and above that accomplished by the effective recuperation of the heat of the escaping gases.

As an example of the efficiency of this system of recuperation, it may be stated that the flue gases of a "Revergen" furnace, 4 ft. 6 in. × 3 ft. × 2 ft., consuming 370 cub. ft. of gas per hour, and maintaining an oven temperature of 1,050 deg. C., did not exceed 65 deg., at which temperature only 2 to 2½ per cent. of the heat generated by the gas consumed is carried off.

The construction of the "Revergen" furnace varies slightly in detail according to the size. Speaking generally, it consists of an outer shell of sheet steel, strengthened by channels, tie rods and thrust plates, the body of the furnace being built up of extra thick Scottish firebricks. A counterbalanced rise-and-fall door with the necessary actuating gear is provided either at one end or at both ends, as required. Heating is effected by town gas combined with air at a pressure of a few inches water gauge. The gas and air are introduced separately, each being controlled by a valve, and means are provided for accurate adjustment. A double set of recuperators are built underneath the oven, and are of a capacity to extract from the escaping gases the maximum amount of heat, which in due course is transferred to the air on its way to the combustion chamber.

The possibilities of fuel saving in the firing of furnaces with gas are most manifest from an examination of the flue-gas temperatures of existing types, and the chart (Fig. 2) has been prepared to show graphically

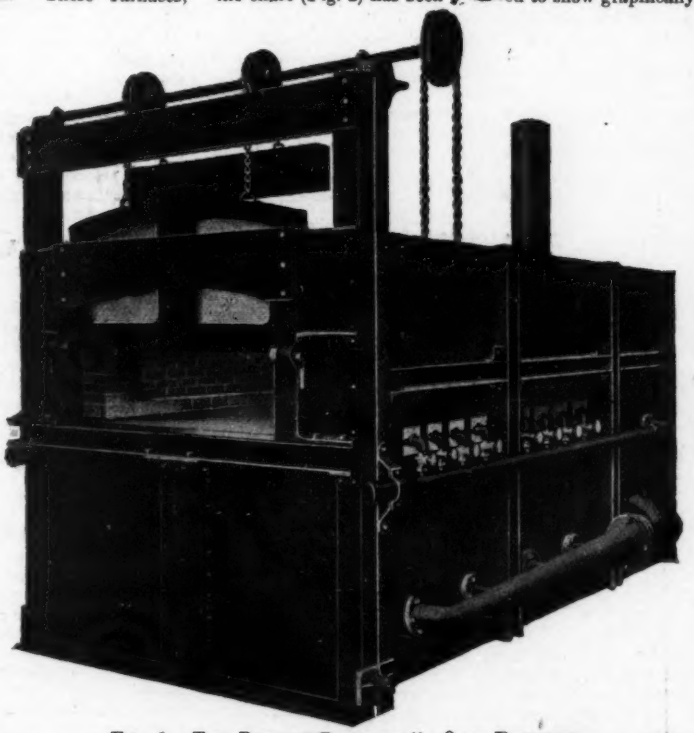

FIG. 1.—THE DAVIS "REVERGEN" OVEN-FURNACE.

the percentage of heat carried away at various flue gas temperatures, calculated on the assumption that 1 cub. ft. of gas has a calorific value of 140 calories, and requires 5 cub. ft. of air for its combustion. It will be seen from the chart that in the case of a furnace generating a temperature of 1,000 deg. C., with a flue gas temperature of 900 deg., about 40 per cent. of the heat generated by the gas consumed in firing is lost by way of the flue. If, therefore, the flue temperature can be reduced, by efficient recuperation, to, say, 50 deg. C., the heat loss will be about 2 per cent. only, and a saving of 38 per cent. will be effected by this means alone. In the case of an oven-furnace, however, efficient recuperation will ensure that the air entering to support combustion will be highly heated during its passage to the combustion chambers, thus promoting a higher flame temperature, and creating, within the furnace, conditions conducive to higher efficiency.

Assuming the air entering the furnace in sufficient

quantity to support combustion to be pre-heated to 1,000 deg. C., such air will carry with it about 32.8 per cent. of the total heat generated by the gas. If it be heated to 800 deg. the recuperation value of the air will be 26.2 per cent.; if 600 deg., 19.2 per cent.; and if 400 deg., 10.1 per cent.

Again, taking an air-blast furnace working at 1,250 deg. C., with 60 per cent. of the heat generated passing away through the flue, if by an efficient system of recuperation the flue-gas temperature can be reduced to, say, 200 deg., the heat loss is brought down to 7.1 per cent., showing an economy of nearly 53 per cent. These figures are, of course, based on the assumption that the whole of the heat represented by the reduction of the flue-gas temperature is recovered and transferred to the ingoing air. In actual practice, however, this result is, of course, not completely achieved, but the theoretical economies quoted demonstrate the need for, and the possibilities of, fuel saving in gas furnaces, and it is these possibilities that the "Revergen" principle attempts to realise in actual practice.

Among some of the general uses for which the "Revergen" furnace is built are case-hardening and heating, hardening, annealing and normalising, billet-heating, the heat treatment of refractory materials, the melting of metals such as copper and pig-iron, etc. The following results have been obtained with a "Revergen" furnace 4 ft. 6 in. × 3 ft. × 2 ft. in

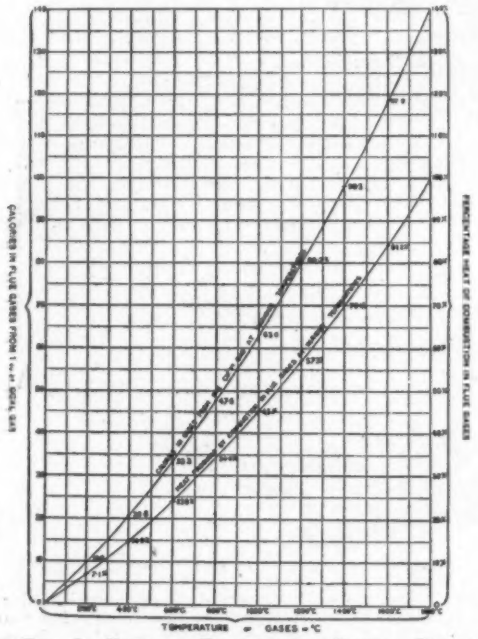

FIG. 2.—FLUE-GAS TEMPERATURE CHART. BASIS CALORIFIC VALUE=140 CALORIES.

the heating of mild-steel billets to the forging temperature of 1,100 deg. C. :—

Heat.	Weight of charges. Lbs.	Gas per lb. Cub. ft.
1st	1,120	5.36
2nd	1,080	1.63
3rd	1,114	1.61
4th	1,114	3.60

The first of the heats dealt with in the above table was made in a dead-cold furnace in frosty weather and with cold billets; the second heat immediately followed the first; and the third immediately followed the second. The fourth heat, however, followed the third after the furnace had been shut down for the ordinary week-end stop, this fact accounting for the increased rate of gas consumption as compared with that for the second and third heats.

The following are the duly certified results at a national gun factory:—Gas consumption per lb. of billets to raise the cold charge to 820 deg. C., 1.3 cub. ft.; gas consumption per lb. of billets to maintain the charge at 820 deg. C. for one hour, 0.341 cub. ft.

British Manufacturers' Corporation and the Federation of British Industries.

A memorandum from the Provisional Committee of the British Manufacturers' Corporation sent out recently to firms associated with the Corporation describes interesting developments in connection with Sir Charles Mandleberg's scheme for the expansion of the British export trade.

These proposals attracted considerable interest and obtained substantial support among business men when they were put forward a little over a year ago. It will be recollected that in September last a representative meeting of manufacturers, held in Manchester, resolved to form an organisation to carry the plan into effect, and a provisional committee was appointed, with Sir Charles Mandleberg as chairman, to bring the British Manufacturers' Corporation into being for that purpose. Over 300 firms in England, Scotland, and Ireland had agreed to be associated with the proposals, forming a substantial nucleus for the new organisation, and a couple of months' spadework in Committee resulted in concrete proposals being ready for submission to the associated firms. Matters had reached this stage when, towards the end of November, the Committee were approached by the Federation of British Industries with a view to effecting a fusion with that organisation. The Federation has a membership of over 800 individual manufacturing firms and about 170 trade associations. Its Overseas Trade Committee, desirous of a progressive overseas trade policy, reported that after careful consideration they had come to the conclusion that the principles first formulated in Sir Charles Mandleberg's scheme were sound, and that they had made them the basis of their own proposals. In these circumstances they thought it would be a great waste of energy and lead to overlapping if the scheme went through independently, and they suggested a fusion of the British Manufacturers' Corporation with the Federation for the purpose of carrying out the schemes.

A general meeting of the Federation on December 12 approved the proposals, and as the result of the negotiations then opened conditions of fusion have been agreed upon by the respective committees, and these were submitted to a general meeting of the British Manufacturers' Corporation on February 20.

The terms of the proposed amalgamation make it clear that the export trade development policy on which the Federation is about to embark is identical in essentials with the scheme first suggested by Sir Charles Mandleberg, which has already been dealt with in these columns.

Under the agreement the British Manufacturers' Corporation is to have immediate and substantial representation on the committee that will administer the scheme. The Provisional Committee of the British Manufacturers' Corporation in their memorandum state that they have been largely influenced in their decision to recommend fusion by their belief that under the conditions arranged the Commissioner service will be carried out in the spirit in which the proposals were first drafted by Sir Charles Mandleberg, and afterwards adopted by the British Manufacturers' Corporation, as a hopeful and practical working policy for the speedy expansion of the British export trade.

High Tensile Brasses.

At a meeting of the Birmingham Metallurgical Society on February 13 (Mr. Isaac E. Lester in the chair), Dr. O. F. Hudson lectured on the alloys of copper, particularly those consisting essentially of copper and zinc, usually known as high-tensile brasses. Brasses, he said, might be divided into two kinds: (1) The pure or simple brasses consisting essentially of copper and zinc only, and (2) the special or complex brasses in which various other metals were present in important quantities. He pointed out how the tensile strength reached its maximum in the simple brasses when the copper amounted to between 50 and 55 per cent.

Having dealt with the modifications by working and heat treatment, Dr. Hudson said that the simple brasses were also modified by the presence of metals other than zinc and copper. Small quantities of those other metals were usually present as impurities, but they were frequently added with a more or less definite object. Thus lead was added to give good machining properties. Special or complex brasses were manufactured now in many varieties, and were very widely used. The effect of each of the metals—tin, lead, iron, manganese, aluminium, and nickel—when mixed with brasses was referred to, and Dr. Hudson said that there was very little reliable information available as to the combined effect of two or more of those metals. Tin increased the strength and hardness; but the amount that could be usefully added was limited to small percentages, varying with the general composition of the brass, because when those limits were exceeded serious loss of ductility might result. It seemed clear that in the finished brass tin should be retained in state of a solid solution, and there was no advantage, but a decided danger, in the presence of tin in excess of this limit of solubility. In some alloys tin was added also for its effects in reducing the liability to serious corrosion. When tin was a constituent of more complex brasses it was usually in such quantities as to be retained in solution. The careful control of the amount of lead was of great importance in determining the quality of brass.

Iron increased the hardness and strength of brasses, while another metal very largely used for the production of high-tensile brasses was manganese. This increased the tensile strength and elastic limit, but usually decreased the elongation. A number of special brasses contained nickel to the extent of as much as two to three per cent., and the use of nickel in brasses was now of considerable importance. Aluminium in small quantities gave increased strength and a high elastic limit, without very seriously affecting the ductility. It was hardly ever used alone, but was usually found in association with other metals, such as iron, manganese, and nickel. Generally, the high-tensile brasses contained more than one added metal, and it was not easy to state in every case the exact function of each.

The structure of the complex brasses, as a rule, was essentially the same as that of the simple, comparatively put, copper-zinc alloys, the added metals in most cases being retained in solution. The special brasses, however, generally had a finer-grained structure than the corresponding simple brasses. It was probably not good practice to attempt to raise the elastic limit of simple brasses by cold working.

Annealing in the ordinary sense lowered the tensile strength very considerably, but annealing for a short time at a low temperature actually gave rise to an increase of tensile strength in the case of cold-rolled brass, and, although the yield point was lowered, it still was higher than in the fully-annealed metal, and the metal had a comparatively high resistance to fatigue. Tensile strength might be still further increased by work, but in any case a large proportion of the increased strength, as compared with the simple brasses, was inherent in the alloy, and was not artificially produced. It was probable that some, at least, of the modern special brasses were unduly complex in character. Although the hardness and strength produced by cold working were artificial in character, those qualities under suitable conditions were not easily lost, and it would appear desirable to make the fullest possible use of them. The strength due to cold working was permanently lost if the metal was subjected to high temperatures.

It was quite evident that complex brasses, with various added metals, gave very appreciably stronger material, and, in many cases, were as ductile as similar simple brasses. Their machining qualities for rapid work in some cases presented difficulties. There seemed to be a certain amount of evidence of unreliability, probably because these complex brasses did not always give good fatigue values. Comparatively simple brasses might be obtained which, with suitable heat treatment, had decidedly superior resistance to fatigue.

Having regard to the varying character of the special brasses, he thought it was not surprising that there was sometimes a tendency to prefer more simple brasses, although they had not quite so high a tensile strength. The possibilities of special brasses did not seem to be by any means exhausted, and he thought that the most fruitful line of work would probably be in the determination of the extent to which heat treatment and mechanical work could be applied, and the present complexity of these modern brasses could be modified.

Industrial Training.

In view of the importance of providing industrial training such as is required by large numbers of the demobilised members of H.M. Forces and civilian war workers who are being set free from their war occupations, the Government have decided to set up a special Department of the Ministry of Labour to deal entirely with questions of industrial training.

The Minister of Labour has appointed Mr. James Currie, C.M.G., formerly Director of the Munitions Training Section of the Labour Supply Department of the Ministry of Munitions, Controller of the new Department.

This Department will not only administer various schemes for the vocational training of discharged soldiers and sailors, of civil war workers of either sex, and of women who are being discharged from the various auxiliary corps, but will, in due course, take over from the Ministry of Pensions the training of disabled men, with the exception of those who require medical supervision or training of a curative nature.

Further, the new Department will lay down the general lines upon which the training of serving soldiers and of men in hospital will be carried on.

Representatives of the Trade Unions and employers will be consulted in regard to the proposed systems of training so as to receive their advice and co-operation in the work of the Department. Arrangements are also being made to ensure the interest of local authorities in all training work.

The Boy in Industry.

A little more than a year ago, in order to attract attention to a work which the exigencies of a state of war necessitated, Mr. Robert R. Hyle, Director of the Boys' Welfare Association, published in "The Daily Telegraph" a series of articles under the title "The Boy in Industry," which, at the time, created a good deal of interest. The movement was primarily intended to deal with the thousands of boys who, in munition factories throughout the country, were "doing their bit" to support the burden of war. Since then boys' welfare work has made an impression on the minds of business men, and they have realised that in the future it must be given an important place in their ordinary business organisation. Therefore, in order that the work may be continued in a more permanent form, and developed on broad human lines in a wider field than that in which it was originally designed to operate, several leading employers have decided that industry itself must accept responsibility for the work, and the organisation of which Mr. Hyde is the Director has been formed.

A fact which so many people as yet fail to recognise to-day is that employers and employed are working together in a common interest, and Mr. Hyde, in a pamphlet recently issued, expresses the opinion that there is between the two "sides" far too much antagonism and suspicion.

In the recently-published reports of the Commissioners on Industrial Unrest great stress is laid upon the need in industry for a change of outlook both on the part of employers and employed.

As regards supervisors, there is, in the minds of both boys and men, an idea that the newly-appointed supervisor is either a superannuated Sunday school teacher, or a tame policeman—with all the faults, but possessing none of the power of the real article. It has been found advantageous if the newly-appointed supervisor is introduced to the foremen and managers by a responsible member of the firm, who can also explain to them just what his position and duties are. In the early days of the movement it was thought that there might be a certain amount of opposition from foremen, on the ground that the supervisor would be interfering with their authority. In practice this fear has been dispelled, and on all hands testimony is paid to the help such an officer is able to give to those who are already overburdened with problems of output. Frequently a foreman receives a letter from a parent requesting information about a boy's time, wages, prospects, etc. The latter requires an answer, but it is not always convenient at the time to acquire the details necessary for the purpose. Instead of putting the matter off, or sending a reply which will not give satisfaction to the writer, it is a much more satisfactory to all parties if the matter can be given to the supervisor for inquiry and reply. He can spend time in turning up the necessary details in the time or wages office, and either write to the parent or visit the home.

A boy is not always to blame for apparent misdemeanour or idleness. A misunderstanding, or some bodily ailment, may be the cause. In some firms committees of boys have been formed to deal with the various matters in which boys are concerned, with excellent results. A boy is elected by each shop or department, and they exercise their authority splendidly. Through the members of the committee, of which the supervisor is the chairman, he can get into speedy touch with the whole of the boys in the works. Likewise, representation can be made by boys to the committee member for their particular shop or department. In such a way personal relationship between the supervisor and the boys soon develops.

The supervisor in many firms has been entrusted with the engagement of the boys. In some cases he is entirely responsible for taking on every boy employed, whilst in others he merely makes a preliminary selection, weeding out those who are obviously unfitted for the work required to be done. Foremen, etc., are, or should be, too busy to devote adequate attention to this matter. At the same time, it is perhaps only reasonable, since he is held responsible for the technical operations of those under him, that the foreman should have the final selection; this, however, is purely a matter of internal arrangement in individual firms. In any case the boy's engagement should be made an important event in his life. It should not be undertaken in a careless, slipshod manner.

In one of the northern shipyards it has been customary for some years past to import boys from the Highlands. The boys, strangers to city scenes, would arrive, shy, bewildered, without guidance, they would seek lodgings; alone they would face the strangeness of work in a vast crowded yard. It was not therefore surprising if, after a few weeks' work, a boy left his job in order to find his way home again, or, as so often happened, drifted, simply through lack of guidance, into channels undesirable and dangerous. The custom now obtains by which the supervisor is notified of all boys who are to enter the yard from distant parts. The boy is met at the station, and is provided with a meal. He is shown to his lodgings, which have already been approved by the supervisor, and when he finally arrives at the yard he is handed over to the foreman under whom he is to work. The boy now feels that there is a friend in the place to whom he can appeal when things go wrong, but, what is perhaps just as important, parents are more inclined to trust their boys away from home, since they know that attention is being given to those matters which concern their well-being.

It is important that the supervisor should be present at the medical examination, which under the Factory Act is made by the certifying surgeon, but the examination is frequently little more than a farce. A supervisor can improve its usefulness by providing for the visiting doctor a record of the boy's past medical history, by arranging that the examination is held in a suitable place, and by obtaining from the doctor suggestions as to treatment when such is required. A boy may be in need of glasses, or his teeth may require treatment, etc.

The supervisor should visit the home of every boy engaged, not as a policeman, nor as a schoolmaster, but as a representative of the firm with which the boy is about to share a common interest. Such visits are welcomed and encouraged, and cannot fail to make for good, both in relationship and increased interest.

In a certain works bad timekeeping had become a habit. There was no real reason why fifteen minutes should have been lost every morning by so many workers; it was merely a habit condoned. A competition was started, and a spirit of rivalry set up between the various shops. Charts were prepared—simple but obtrusive—showing the position week by week of each set. In three months the lost time was reduced from 5,000 hours to 2,000 hours. In another firm, a saving of over 40 per cent. was effected in the same way.

It has been found that the presence of a supervisor has brought about, even in the most unlikely places, a vastly improved state of affairs in connection with the boys' continued education. Sometimes the head of a firm is anxious that his boys should attend evening classes, and goes so far as to offer prizes for the best attendances and results. Being busy with other matters he overlooks the fact that boys are just about played out by the time their day's work is through. It is necessary for somebody in the works, not only to point out to the management the desirability of allowing boys, who desire to attend classes, either to leave work early or to turn up late on the following morning, but also to make himself responsible for organising a system by which such a privilege may be kept within the bounds of regulated order. It is equally necessary that it shall be somebody's duty to persuade the boys to make use of the facilities offered. During the past year many splendid results have been

achieved, and there is little doubt that a great development in this very desirable direction will take place in the near future.

In several works schools have been equipped, not only for boys who are destined to become highly-skilled craftsmen, but also for those who are almost bound to spend their lives in unskilled or semi-skilled labour. Or, again, in connection with various works, visits have been arranged to places where the boys could see in actual use machines, or parts of machines, which they had made or helped to assemble. Boys engaged in the manufacture of haulage plant were taken down a coal mine; others engaged in making electrical plant were taken to a generating station. Another set of boys engaged in wire making were taken to an aerodrome, where a friendly pilot gave them an exhibition flight.

Another development of the boys' welfare scheme has been the publication of works' magazines. Partly educational, partly personal, partly humorous, they serve a useful purpose. Regarding the all-important matter of thrift, it is gratifying to learn that much has been accomplished as a result of personal influence and persuasion. According to a supervisor who was in charge of about 400 boys engaged in a Midland steel works, 300 were paying in for War Certificates. Many of these had never attempted to save money before, and payments were well kept up. One of the most interesting features of the movement described, and one which is well worth consideration is the attitude adopted by the adult workers. Again and again, in places where a sympathetic supervisor has commenced work amongst the boys, men have approached him in connection with all kinds of questions relating to their own affairs.

Finally, the supervisor should endeavour, so far as possible, to make himself responsible for the recreation of the boys. Whether it takes the form of indoor recreation entailing the provision of club premises, or the supply of outdoor facilities in the shape of a games field, or both, he cannot fail to perform a service of the very highest importance. Recreation has been fostered in many districts. In Glasgow, a flourishing football league, consisting of workshop and shipyard teams, is bringing its first season to a successful close. It has served to stir up a great deal of friendly rivalry amongst the boys and their respective adult followers. By another firm a week-end camping hut has been provided, where, in the midst of beautiful scenery, boys (25 at a time) can forget for a spell the hurry of city life and the sound of hammered iron. In many parts of the country swimming clubs, gymnasia, rambling clubs have been started, and sports gatherings and concerts arranged, whilst provision for more formal exercise has been provided by means of such organisations as brigade and cadet corps.

The old idea of apprenticeship, as generally understood, is for the bulk of working boys to-day a thing of the past. Competition, advancement, increasing knowledge, organisation, are bringing in their train a demand for workers who must spend their days on automatic processes. The work may be monotonous, but it is useless sighing for days that have gone. If work is destined to become less interesting, then let us see to it that an antidote is provided by giving the boy wide interests in his leisure hours.

Employers of boy labour who wish for further information on the subject, or who desire to get into touch with men, invalided officers and others, whose qualifications fit them for the task, are invited by Mr. Hyde to write to the Director, Boys' Welfare Association, Sanctuary House, Tothill Street, Westminster, S.W.1.

ALTHOUGH the London Iron and Steel Exchange will be open for the transaction of business on each Tuesday from 1.30 to 4 o'clock, "High 'Change" will be from 2.30 to 3.30 o'clock. Inquiries from buyers will be posted on the notice-board on the Exchange each week.

Specific Density of Forged Steel.

MR. H. E. DORRR, chief mechanical engineer of the Scullin Steel Company, St. Louis (U.S.A.), in a Paper presented to the American Institute of Mining Engineers, stated that he has been unable to find much information relative to tests made to determine the effect of forging on the specific density of steel. The opinion, however, among men engaged in the business seems to be that forging greatly compresses or consolidates the steel. While such is doubtless the case with spongy or porous steel, the following experiments indicate that there can be little or no change in the density with steel initially free from cavities.

Ten ingots of basic open-hearth steel were used in the experiments. All the specimens were of 0.53 per cent. carbon with all other elements the same, the analysis being determined from drillings taken midway between the centre and outside of the upper end. The specimens were selected from over 1,000 ingots so that the tests could be comparative for the work done in forging only, but no two of the ingots were cast in the same heat. Each ingot remained in the mould about 30 min. when it was removed and air-cooled. About 12 hours later, when the temperature had been reduced to about that of the surrounding atmosphere, the head was discarded and the ingot heated in an oil furnace to about 2,250 deg. Fah. About 1 min. was required to forge under the steam hammer to 1½ in., rough diameter. All ingots were allowed to air-cool after forging. Rods ½ in. in diameter and ½ in. high were then turned from the forged and unforged parts of the ingots and numbered.

The 10 pairs of specimens were submitted to the professor of railway mechanical engineering of the University of Pittsburgh; the professor of applied mechanics, University of Illinois, and to the chief chemist of the Scullin Steel Company, St. Louis. No information was furnished as to which specimens were forged or unforged, and each laboratory used the same specimens, submitting the average of three independent determinations, which are shown by the author in a table in which the laboratories are designated by A, B, and C. While there was considerable difference in the individual determinations for a number of the specimens, the averages for both the forged and unforged specimens were very close. The determinations of each laboratory indicated, with a single exception, that the forged steel was the denser of each pair. Assuming that all cavities, however small, were completely closed, the average results indicated that only 0.64 per cent. of the sectional area of the original ingot consisted of cavities.

The following table shows the average densities of the 10 pairs of specimens, forged and unforged:—

	Density.			
	A	B	C	Average.
Average of forged ...	7.821	7.849	7.845	7.838
Average of unforged ...	7.782	7.798	7.803	7.788

HARDNESS OF SOFT IRON AND COPPER.—According to a recent Paper read by Mr. F. C. Kelley, research physicist, General Electric Company, Schenectady, N.Y. (U.S.A.), before the American Electrochemical Society, samples of American "ingot iron" and ordinary commercial cold-rolled copper were given similar treatment in an electrically-heated vacuum furnace, and then carefuly tested for hardness by the Brinell methods. The treatment consisted in annealing several hours at 770 deg. C. to 960 deg. C., annealing in hydrogen and in a vacuum. Commercial copper ranged from hardness 80, as received, down to 40; ingot iron from 95 down to 60. The dead-soft iron can be whittled with a knife, and may find uses in place of pure soft copper.

The Government Scheme for Industrial Research.

The Government, as already announced, have placed a fund of £1,000,000 at the disposal of the Scientific and Industrial Research Department to enable it to encourage the industries to undertake research. The Advisory Council have recommended, after consultation with manufacturers and others, that the new fund should be expended on a co-operative basis in the form of liberal contributions by the Department towards the income raised by voluntary associations of manufacturers established for the purpose of research. By this method the systematic development of research and the co-operation of science with industry will be carried out under the direct control of the industries themselves. It is also hoped that the co-operation of the firms concerned in any one industry may enable research work to be undertaken which could not have been dealt with by individual firms.

The Department realises that there will be many difficulties in the way. Some industries are large and well organised or their dependence on science is obvious, while others are either small, badly organised or are not obviously based on the application of scientific principles. Again, some industries are from their nature mainly interested in research because they are users of certain materials which are susceptible of improvement, and these materials are also used by other industries. Experience has shown that in some cases a Research Association may be established for the whole of a complex industry, whereas in others it is most convenient for only the firms engaged in a single section to combine to form an Association. Generally speaking, it is difficult to combine in a single Association both the makers and the users of any commodity, though there is one instance where the attempt to do so has been successful. It appears to be certain, however, from these considerations that some firms will wish to belong to more than one such combination for research purposes, and that if wasteful effort is to be avoided every possible means must be used to encourage co-operation between different research organisations as well as between the several firms within the same organisation.

It is anticipated that each firm subscribing to a research organisation will have the following privileges :—(1) It will have the right to put technical questions and to have them answered as fully as possible within the scope of the research organisation and its allied associations. (2) It will have the right to recommend specific subjects for research, and if the Committee or Board of the research organisation of that industry consider the recommendation of sufficient general interest and importance, the research will be carried out without further cost to the firm making the recommendation, and the results will be available to all the firms in the organisation. (3) It will have the right to the use of any patents or secret processes resulting from all researches undertaken either without payment for licences, or at any rate on only nominal payment as compared with firms outside the organisation. (4) It will have the right to ask for a specific piece of research to be undertaken for its sole benefit at cost price, and, if the governing Committee or Board approve, the research will be undertaken. No firm outside the organisation will have any of these rights. The documents and bulletins available for members of the organisation will not be published unless the controlling committee of the organisation decide that they shall be.

There are other privileges to which each firm subscribing to a Research Association will be entitled if the Association decides, as several Associations have already done, to establish a Bureau of Information. If this is done each firm will have the following privileges :—(1) It will receive a regular service of summarised technical information which will keep it abreast of the technical developments in the industry at home and abroad. To do as much for itself any firm would have to employ more than one man on its staff reading and translating the technical press. (2) It will be able to obtain a translated copy of any foreign article in which it may be specially interested, and to which its attention will have been drawn by the periodical bulletin.

The method of assessing the subscription of each firm will have to be determined in negotiation with each industry or section of an industry which may agree to combine for the purposes of research, but the intention is that firms should contribute on a basis proportionate to their size. Thus the small firm will contribute less than the large firm, yet it will have the same privileges, though as a rule it will not in the nature of the case have the same facilities for exploiting the results of research.

The whole of the results of researches conducted by any Research Association will belong to the Association itself, which will hold them in trust for the benefit of its members. The Government is, however, specially bound to safeguard the national interests where new discoveries are made with the assistance of Parliamentary funds, and accordingly, besides the powers it already possesses under the Patents and Designs Act, 1907, it will keep in its own hands two additional powers, which may be said to limit the absolute ownership otherwise reserved to the Association—the right of veto in case any proposal is made by a Research Association to communicate any results of research to a foreign person or to a foreign corporation, and the right, after consultation with the Association concerned, of communicating the results of discoveries to other industries for their use on suitable terms. The Department will not, however, make any results obtained by a Research Association available to firms or individuals who are eligible for membership of that Association but have not joined it.

Blowing Air into Electric Steel.

According to an article in the "Iron Trade Review" by Mr. C. M. Carmichael, Mr. Ernest Humbert has been granted patents for a process for making metals in electric furnaces, which consists of blowing air into the solid charge. After the furnace is tapped and all necessary repairs have been made to banks and bottom, it is charged with scrap. By the time the principal portion of the charge is in the furnace the lower part has become incandescent. The electrodes are then lowered and the current turned on. The air is introduced into the solid but incandescent part of the charge by a pipe, about 1 in. in diameter, connected to a flexible hose. The air is supplied at any convenient pressure by a simple compressor or blower.

When the air is blown into the solid incandescent part of the charge, the carbon monoxide formed at the point where the air strikes the metal is immediately converted into carbon dioxide and burns with a white flame, melting the charge quickly, the pipe being raised from time to time in order to keep the air playing on the solid part of the metal until it is entirely melted. The oxygen in the air oxidises the carbon, silicon, and phosphorus, causing a great rise in temperature and thereby reducing the melting time. The writer in using this process, found that the time saved on each heat to be from 25 to 50 per cent., varying with the composition of the charge and the metal to be produced, thereby saving from 175 to 350 kw.-hours per ton of metal produced.

Besides the power saved it is possible by this process to make use of almost any grade or kind of scrap; for instance, cast borings or other material high in carbon for making steel with 0.08 to 0.25 per cent. carbon without the addition of so much iron ore or other oxidising material. Such material as a rule creates a violent boiling and a slag heavy in iron oxide; this causes considerable wear to the furnace lining, roof and electrodes. Taking the three fundamental factors which determine practically all steel-making processes, the

chemical composition of the material, the temperature, and the time, we know that the more perfectly these elements are controlled during the operation, the more perfect are the results obtained. Therefore, knowing the composition of the charge and knowing that one kg. of carbon oxidised to CO_2 produces 8,100 calories, one kg. of silicon to SiO_2 produces 7,830 calories, one kg. of phosphorus to P_2O_5 produces 5,965 calories, and knowing the oxygen content of the air, the volume blown into the furnace can be measured. Then it is easy to calculate the amount of heat that will be generated by the oxidation of these elements, thereby showing the amount of power saved, and also the length of time the melting and blowing operation should be continued to procure steel of the desired composition. Also, on account of the extra amount of heat created by the air, the bath, at melting down, is about at the right temperature for making such ferro additions as are desired.

Everyone familiar with electric furnace practice knows that the load factor for a period of 24 hours is comparatively low, for the reason that when making steel from cold scrap the demand for the last fifth of the refining period is about 20 per cent. less than the demand during the first four-fifths of the time. By introducing air into the solid part of the charge the heat in the furnace is increased, which decreases the melting time, thereby decreasing the demand for power during the melting period, which increases the load factor and the efficiency ratio of electrical energy transferred as heat to the charge.

It is further claimed that not only is this process used to advantage in making steel but also in making pig-iron. The writer has found by practice that with the use of air as described for making pig-iron in electric furnaces, 350 to 600 kw.-hours per ton of metal were consumed with an average time from tap to tap of 3½ hours, while without the air, the power consumption was from 600 to 800 kw.-hours per ton of metal with an average time of five hours from tap to tap.

Work for Women.

A report on the substitution of women for men workers in non-munition factories during the war has just been issued by the Home Office. It is pointed out therein that the memorandum is intended only as a record of the war experience in regard to the employment of women on new processes, and that it is not in any sense intended as a suggestion as to the policy to be adopted after the war in regard to their employment. While substitution has in many cases been found most successful in those industries where women were already at work in some sections, and where the work to be carried on was obviously suitable for them, there have been many striking exceptions to this rule. For instance, there was comparatively little successful substitution in the textile trades. On the other hand, when, owing to the increasing pressure of national emergency in the later stages of the war, women were brought—frequently with reluctance on the part of the employer—into certain trades and occupations which from the nature and conditions of the work were previously held to be quite unsuitable for female labour, they often did remarkably well. Although much has been done to safeguard the temporary employment of women in such trades, it remains, in the main branches as at present developed, on the whole undesirable and uneconomic. It is therefore probable that women will go out of these branches as soon as a sufficient supply of male labour is available.

Although no large substitution of women in management has been reported, instances of such substitution, either as manager or as assistant manager, are recorded as having been successfully made in several industries. Among those mentioned are the following: Metallic steel and hardware (general manager), chemical works, general engineering, aero engine works, rolling mills, tin boxes (assistant managers), motor repairs and aircraft parts (business manager and works manager) and others. Non-munition industries only are under consideration; otherwise, remarkable instances of success in skilled processes. The tendency has been to train for one or two operations only, and the result has been the creation of an army of women who may be described as "semi-skilled," i.e., thoroughly proficient in certain operations (mainly repetition work), for which they have been definitely trained.

Summarising their conclusion, the authors of the report state *inter alia* that the question of the future employment of women in all industries under agreement, whether national or applicable to a single trade or operation, hinges on the arrangements to be made on the return to normal conditions between organised labour, the employers and the nation; it is part of that larger question of the restoration of trade union conditions and the problems arising out of it, touching the solution of which no forecast is attempted here. Two considerations, however, arise at the present stage. First, there would appear to be a fairly large new field of the appointment of women to full management in shell, cartridge, and filling factories could have been given, and there is undoubtedly large room for the employment in future of the best type of working women in management.

The Ministry of Munitions, through their training schools, have shown how successfully women may be prepared for the duties of shop supervisors and forewomen. With the entry of women into the more skilled branches of trade there has arisen a demand for the technically-trained forewoman, which will certainly persist, and may even increase, after the war, when the staffing of the upper ranks of women's trades by men will frequently present difficulties. As regards scientific work, there are indications that considerable avenues of employment are likely to be open in future for (a) university women as works chemists and in research work in factory laboratories; (b) intelligent working women in routine laboratory work.

Dealing with process work, the report states that very few women substituted for men since the war could be described as "skilled," but judicious subdivision has enabled them to be employed with great possible future activity for women in trades into which they have been brought during the war without agreement. Second, it seems clear that if the country's industries are to be maintained and its wealth increased (matters of vital importance in view of war losses, expenditure, and debt), the employment of women must be much more extensive than heretofore. Large numbers of men have been incapacitated for their previous industrial occupations; great extensions of factory premises and plant have taken place during the period of the war, and it may reasonably be expected that for many years to come there will be a demand for production from British factories in excess of the pre-war output. To meet this demand fresh supplies of labour will be needed, and the only considerable untapped reserve of labour existing before the war was the labour of women. It is therefore to women that the nation must look to supply any largely-increased demand for workers.

Machine Tools.

The Minister of Munitions announces (Notice No. 7) that restrictions upon the release of new machine tools and woodworking machinery have been removed, provided such machines are purchased from firms or persons holding permits from the Minister to trade in such articles. It is consequently no longer necessary for firms desirous of purchasing such machines to make application to the Ministry of Munitions for release certificates before placing their orders with the manufacturer or merchant, as the case may be.

It should be pointed out that the restrictions upon the purchase or sale of second-hand machine tools and woodworking machinery have previously been removed.

Loughborough Technical College.

A meeting took place recently at Loughborough Technical College, where over 100 delegates representing the engineering industry of Great Britain assembled at a conference from places as remote from each other as Glasgow, Reading, Bristol, and Newcastle. The conference was called to discuss whether it was advisable to carry on the College in peace-time channels.

MR. SCHOFIELD (the Principal) announced that about 140 letters of apology had been received from engineering firms in the country, not one of them offering anything in the nature of adverse criticism, and all expressing approval in some form or other of the proposals.

MAJOR BROCKINGTON (Director of Education) stated, in the course of a speech, that he knew that the continuance of the College must be a State venture, and it was in order that the Governors might test the feeling of the industry primarily concerned, as they would not ask nor expect financial aid from the industry for the scheme, but they would need its support and co-operation. He would like to suggest to the industry the offering of works scholarships tenable at this College, but beyond that he should not accept definite financial support from the industry as the State would provide for that. The College was in a unique position to give the necessary practical tuition, and there were three points with reference to it which he should like to bring forward: (1) One suggestion would be that the industry should help the College by giving it contracts for work. (2) So far as he was aware, there was only one other institution such as this, and that was at Worcester, Massachusetts, which attempted to give training upon the methods for which they in Loughborough stood. (3) He looked forward to the time when the engineering industry should exercise some sort of control over the technical education in its own branch of knowledge, and here again the Conference would shortly have an opportunity of testifying for or against this idea. There had been a suggestion that the Instructional Factory might form a part of the scheme for an East Midland University He wished to make it quite clear that he did not desire any connection with such a University, which would interfere with the practical nature of the scheme of work in the College, nor would they abate one jot of their practical ideals.

MR. W. JOHNSTONE (Brush Electrical Engineering Company) next moved the following resolution:—"That this meeting of delegates representing engineering employers throughout the country approve of the proposals laid down for the establishment of a school for engineering training, where the practical part of the instruction is given on a productive system under works conditions. Works training as given in the Instructional Factory attached to the College being concurrent with the theoretical training in lecture rooms and laboratories of the same institution."

MR. R. J. HOSKING (British Thomson-Houston Company, Rugby) seconded the resolution.

MR. POLLARD (Engineering Employers' Federation), whilst thoroughly appreciating the work done by the College in the past, believed that its work was no longer necessary. He said quite frankly that he was not in sympathy with the ideals of the authorities of the College. On the other hand, he asked the Conference to note that part of the scheme was to train discharged disabled soldiers. He commended that fully, and would say from experience that it had done good work in the past. In his own firm, amongst their employees, they had 25 per cent. discharged soldiers, many of whom came from the Loughborough College, and were doing good work. He would like to call the attention of the Conference to an instruction which had just been issued from the Ministry of Labour "that while firms employ a single dilutee they must not keep any skilled man out of employment."

MR. WM. TAYLOR (Messrs. Taylor, Taylor & Hobson), representing the Institution of Mechanical Engineers, supported the scheme.

After some further discussion PROFESSOR P. M. BAKER (Ministry of Labour) said that the training proposed by this scheme could not at the present time be obtained fairly in productive shops which were, as a rule, too busy on production to bother with the training of apprentices.

The resolution was then carried.

SIR THOMAS COPE, the Chairman of the County Council, then proposed the following resolution:—"That the engineering employers be recommended to name representatives of the industry to act as an advisory body in order to assist the Governors in the administration of the Works Department of the College."

MR. H. H. MOORE, of the Empress Works, Loughborough, seconded, and the resolution was carried unanimously.

MR. F. POLLARD (Messrs. Pollard & Company, Leicester) then proposed that engineering employers be recommended to consider the possibility of giving definite support to the scheme above outlined, either by (1) the letting of contracts for work, or (2) the granting of scholarships to enable students of suitable attainment to avail themselves of the instruction offered.

MR. WM. TAYLOR (Messrs. Taylor, Taylor & Hobson) seconded, and after some discussion the resolution was carried, and the Conference ended.

Institution of Mechanical Engineers.

The annual meeting of the Institution of Mechanical Engineers was held at Storey's Gate, Westminster, on the 21st ult.

In their annual report the Council stated that there had been a net increase of 133 in the membership, the total at the end of 1918 being 6,439, as against 6,306 at the end of 1917. The accounts for the year showed that the total revenue was £22,723 15s. 7d., while the expenditure was £19,261 19s. 4d. (including £4,500 invested for reserve funds), leaving a balance of revenue over expenditure of £3,461 16s. 3d. The total assets amount to £150,242 11s. 3d., and deducting therefrom the £34,025 of debentures, and other liabilities, together with the total amount of the four reserve funds, viz., £43,543 17s. 4d., the balance-sheet shows a credit balance of £70,619 15s. 5d.

Since the commencement of the war more than 1,200 members of the Institution and ten members of the staff had volunteered, or been called up, for active service. During the past year fifteen members had been killed in action or had died from wounds or sickness.

The following grants were made by the Council, for the year, in aid of the three researches now being carried on under the direction of the Institution, namely: Alloys, £220; steam nozzles, £150; hardness tests, £100. A grant was also made from Sir Robert Hadfield's Prize Fund to Professor C. A. Edwards and Mr. F. W. Willis for their Paper referred to above, with a request that they would continue their researches in the direction of experiments with very hard materials.

Properties of light alloys suitable for constructional purposes, specially the ternary alloys of aluminium, had been further investigated at the National Physical Laboratory for the Alloys Research Committee. The effects of casting, forging, machining, rolling and extrusion had been studied, and microscopic examinations of structure and tests at high and low temperatures had been made. Owing to the military interest of the work no report could yet be published.

Maximum Prices for Pig-Iron.

The Ministry of Munitions have re-issued the complete list of maximum prices for pig-iron for home delivery. The basis prices are unalte.ed, but several brands of special iron have been included, and additional extras are specified. Below we note the additions to the list:—

	£	s.	d.
Malleable Hematite Pig-iron.			
Warner Special O.K.	8	12	6
,, C.P.	10	15	0
,, C.P. Blackheart	10	0	0
Per ton net f.o.t. makers' works.			
Cleveland Pig-iron.			
Foundry or forge iron selected to a specified analysis an extra price per ton of		2	6
Derbyshire, Leicestershire and Nottinghamshire Pig-iron.			
Foundry or forge iron, selected to a specified analysis, an extra price per ton of		2	6
Foundry iron supplied to a specified analysis with a phosphorus content under 1 per cent. an extra price per ton of		5	0
Denby Iron & Coal Company, Limited.			
Denby Scotch	6	10	0
Denby Best	7	10	0
Denby Best Best	8	10	0
Per ton net f.o.t. makers' works.			
Lincolnshire Pig-iron.			
Foundry or forge iron selected to a specified analysis an extra price per ton of		2	6
Northamptonshire Pig-iron.			
Foundry or forge iron selected to a specified analysis an extra price per ton of		2	6
North Staffordshire Pig-iron.			
Foundry or forge iron selected to a specified analysis an extra price per ton of		2	6
Robert Heath & Sons, Limited.			
Special cylinder iron	5	10	0
Per ton net f.o.t. makers' works.			
Yorkshire Iron & Coal Company, Limited.			
Special cylinder iron	5	10	0
Per ton net f.o.t. makers' works.			
Newton Chambers & Company, Limited.			
Price delivered to consumers not to exceed delivered price of Scotch foundry iron (Glengarnock or equal grade). [Per ton net f.o.t. makers' works.			

Manchester Metallurgical Society.

The inaugural meeting of the Manchester Metallurgical Society was held on January 30, Mr. E. L. Rhead, President, in the chair.

Mr. Rhead, in the course of an address on "Metallurgy and its Applications to Industry," referred to the enormous improvements in cast-iron and its applications, and showed how an intelligent appreciation of the effects produced on its properties by the substances present had led to the production of stronger metal and had extended its use both in ordinary engineering work and as an acid-resisting material. Reference was made to the introduction of manganese and tungsten into steel by Mushett, and to the production of alloy steels for manufacturing purposes. On the non-ferrous side, the introduction of nickel and nickel-bronzes in valves, especially for superheated steam, and of copper alloys for die-casting were mentioned, and attention was drawn to the great saving in power resulting from the use of white bearing alloys. The application of fuse metals such as zinc for aluminium alloys and strong brasses and bronzes, and the production of special alloys such as magnalium and duralumin were among the many other contributions of metallurgy to industrial progress. Mr. Rhead, in conclusion, referred to the influence of pyrometric and microscopic work on metallurgical developments. Metallurgy, he said, had been re-born since the introduction of these methods of research.

Disposal of Government Surplus Property.

The Ministry of Munitions announces that, in accordance with the decision of the Government to establish a central authority for the disposal of all surplus Government property, the Minister of Munitions has approved of an organisation for this purpose.

An Advisory Council has been appointed to advise the Minister on such questions of policy as may be referred to them. The names of the Council are as follows:—

The Marquis of Salisbury (chairman), Mr. J. R. Clynes, M.P., Viscount Inchcape, Lord Colwyn, Sir Howard Spicer, Mr. W. L. Hichens, Sir John Ferguson, Mr. F. Dudley Docker, Sir Byron Peters, and Sir Peter McClelland.

The organisation consists of a Board directly responsible to the Minister, to be called the Surplus Government Property Disposal Board. The constitution of the Board is as follows:—

Mr. F. G. Kellaway, M.P., Deputy Minister (chairman), Sir Howard Frank (deputy chairman), Lieut.-General Sir Travers Clarke, Sir Howard L. Connell, Major-General Sir A. E. Crofton-Atkins, Mr. David Currie, Sir Philip Henriques (financial adviser), Mr. Alexander Walker, and Major F. C. T. Tudsbery (secretary).

The departmental organisation is divided into seventeen sections to deal with the different classes of property arising for disposal, at the head of each of these sections being a controller, responsible to the Board. The sections and the respective controllers include the following:—

Lands, buildings and factories, and furniture, Mr. E. H. Coles.

Huts and building material, not yet appointed.

Plant and machinery, Mr. C. L. Morgan.

Timber, Sir James Ball.

Mechanical transport (including tanks and agricultural machinery), Lieut.-Colonel C. V. Holbrook.

Railway material, transportation stores, road-repair machinery, Mr. F. Palmer, C.I.E., M.I.C.E.

Electrical instruments, telephones, and telegraphs, Lieut.-Colonel C. J. H. W. Francis.

Ferrous materials, Mr. B. Walmsley.

Non-ferrous materials, Mr. R. W. Rucker.

Chemicals and explosives and chemical warfare material, Mr. D. G. Duff.

Factory consumable stores, Mr. J. E. Francis.

Aircraft equipment, not yet appointed.

Watercraft and dock plant, not yet appointed.

Miscellaneous stores, Mr. W. J. Larke.

The sections have been arranged in groups, each group being under the general superintendence of a member of the Disposal Board.

Each controller will have the assistance of an honorary advisory committee of men whose special knowledge and experience, the official statement adds, will ensure that the various classes of property are disposed of to the best advantage.

In accordance with arrangements made with the various Government departments concerned, no property surplus to the requirements of these departments will in future be disposed of except through or by arrangement with the Disposal Board. This equally applies to surplus stores in the various theatres of war.

A special section is being set up to deal with sales to neutral countries, and will be under the control of Sir Sydney Henn.

Communications should be addressed to the Secretary, Disposal Board, Armament Buildings, Whitehall Place, London, S.W.1.

Trade Talk.

THE MAGNESITE ORDER, 1917, has been suspended.

CONSIDERABLE damage has been caused by fire in a Londonderry shipyard.

THE maximum price of silver has been reduced from 48 7-16d. to 47¾d. per standard ounce.

THE annual dinner of the Iron and Steel Institute will be held at the Guildhall on May 8.

FRASER & CHALMERS, LIMITED, are being wound up voluntarily, with Mr. W. McDermott as liquidator.

MR. T. MORRILL, metal merchant, has removed to College Hill Chambers, Cannon Street, London, E.C.4.

THE Industrial League, of which Mr. J. Ames is secretary, has removed to 66, Victoria Street, S.W.1.

THE NATIONAL PROJECTILE FACTORY, Dudley, Worcestershire, is being offered for sale by private treaty.

THE Glendinning antimony mines in Dumfriesshire, which are being reopened, were worked over 100 years ago.

MR. H. R. HENSHEL, metal broker, etc., has removed to Suffolk House, 5, Laurence Pountney Hill, London, E.C.4.

THE BRITISH HUHN METALLIC PACKING COMPANY, LIMITED, 24, Basinghall Street, London, E.C., are paying a first and final dividend of 20s. in the £.

THE plant and machinery at the National Shell Factory, Grimsby, were offered for sale by public auction on Tuesday, March 4, and following days.

THE PULVO ENGINEERING COMPANY, LIMITED, is being wound up voluntarily, with Mr. H. Whitfield, of 10, Dane Street, Holborn, W.C., as liquidator.

THE plant and machinery at the No. 3 National Ordnance Factory, Armley Road, Leeds, will be offered for sale by public auction on March 18 and following days.

THE scheme for the new floating dock at Barrow, to be built by Vickers, Limited, has received authority from the Admiralty, and plans are in course of preparation.

THE VICTORIA FOUNDRY AND ENGINEERING COMPANY, LIMITED, is being wound up voluntarily. Mr. G. B. Bowen, Salubrious Chambers, Swansea, has been appointed liquidator.

MESSRS. D. FLYNN AND E. LOWNDES, stamp brass founders, 92, Steward Street, Birmingham, trading under the style of D. Flynn & Company, have dissolved partnership.

THE UNITED STEEL COMPANIES, LIMITED, have blown in two furnaces at their Harrington Works, near Workington, and have now thirteen furnaces in operation in West Cumberland.

IN connection with the sale of the business of the Egis Shipyard, Limited, the company is being wound up voluntarily. Sir W. B. Peat, 11, Ironmonger Lane, E.C., is the liquidator.

AN outbreak of fire occurred in the stores at the Netherton works of N. Hingley & Sons, Limited, but the employés were able to quell the flames before any serious damage was done.

THE shareholders of the Leeds Forge Company, Limited, have passed a resolution to increase the capital of the company to £670,000, by the creation of 400,000 new shares of £1 each

YARROW & CO., LIMITED, intend gradually diminishing their output on the Cylde and increasing their output at their shipbuilding works at Vancouver on the Pacific Coast of North America.

MR. H. G. BOKE has recently been appointed to the position of chief draughtsman to the Queenstown Shipbuilding, Engineering and Dry Docks Company, Limited, Passage West, co. Cork.

ALBERT FROST & COMPANY, LIMITED, 3, Howard Street, Sheffield, have purchased the whole of the plant, machinery, stock, etc., from the liquidators of Arnold Wicksteed & Company, Limited.

THE shareholders of Cranes (Birmingham), Limited, have decided to voluntarily wind up the company. Sir Arthur F. Whinney, 4b, Frederick's Place, Old Jewry, London, E.C., is the liquidator.

MESSRS. A. H. LEA, T. MARSHALL, AND J. WASS, manufacturing engineers, Glenroy Works, Rockingham Road, Kettering, trading under the style of Lea, Marshall & Wass, have dissolved partnership.

THE salvage of copper and brass from the battlefields of France and Flanders is so much greater than was expected that the War Trade Department has been authorised to issue licences for their exportation.

IN connection with the sale of the undertaking of William Gray & Company, Limited, the company is being wound up voluntarily, with Sir William B. Peat, 11, Ironmonger Lane, London, E.C., as liquidator.

THE SUFFOLK IRON FOUNDRY COMPANY, LIMITED, have acquired 2½ acres of land at Stowmarket, for the purpose of erecting an iron foundry. Adequate railway accommodation will run adjacent to the new works.

THE operation of the Agricultural Machines, Implements and Vehicles (Manufacture) Order, 1917, and the Agricultural and Dairy Machines, Implements and Vehicles (Sale) Order, 1918, has been suspended.

THE MINISTRY OF MUNITIONS offer the plant, machine tools, and equipment of the Cork National Shell Factory for sale by private treaty. The building is substantial and covers an area of approximately 15,000 sq. ft.

IT is stated that the purchase consideration for the acquisition, recently announced, of the undertaking of William Doxford & Sons, Limited, by the Northumberland Shipbuilding Company, Limited, amounts to over £3,000,000.

THE shareholders of the Wedmore Engineering Company, Limited, have passed a resolution to wind up the company voluntarily. Mr. G. H. Beaton and Mr. H. J. Gold, 41, St. James Square, Holland Park, W.11, are the joint liquidators.

JAMES MARMON & SON, LIMITED, engineers' and ship-repairers' merchants, 45, Regent Road, Liverpool, have added to their business an engineering and ship-repairing supplies department. This branch is under the management of Mr. I. Robinson.

IN consequence of an explosion at one of the blast furnaces at the plant of the Langloan Iron & Chemical Company, Limited, Coatbridge, one man was killed and three others were more or less seriously injured The furnace was badly damaged.

WM. MCLEAN, LIMITED, Stirling Chambers, Sheffield, have been appointed selling agents in the Sheffield district by George G. Blackwell, Sons, & Company, Limited, and the British Thermit Company, Limited, both of Liverpool, for alloys.

THE undertaking and property of the Nero Engine Company, Limited, are being sold to Riley (Coventry), Limited, and accordingly the former company is being wound up voluntarily. Mr. G. Bostock, 21, Ironmonger Lane, London, E.C.2, is the liquidator.

THE rates of drawback payable on shipment of certain classes of iron and steel have been revised as from the 1st ult. Outstanding licence issued before February 1 upon which the old rates of drawback are shown should be returned to the War Trade Department for amendment.

THOMAS PERRY & SON, LIMITED, have purchased two acres of land adjoining their Highfield Works, Bilston, Staffs., upon which they will shortly commence the erection of a new foundry and roll turning shops. The site of the present foundry will then be taken over for extending the machine shops.

MESSRS. W. R. PEAT, T. PEAT, P. PEAT, AND H. A. PEAT, engineers, millwrights and ironfounders, Hope Foundry, Farnworth, near Bolton, trading under the style of Thomas Peat, have dissolved partnership. Messrs. W. R. Peat, T. Peat and P. Peat will continue business under the style of Thomas Peat & Sons.

BEFORE the members of the Sheffield Society of Engineers and Metallurgists, in the Applied Science Department of the Sheffield University last month, Mr. T. W. Hand, chief engineer of Davy Brothers, Ltd., read an interesting paper on "The Development of Steel Works Machinery." Mr. T. W. Willis presided.

THE TATA IRON & STEEL COMPANY, LIMITED, advise us that Sakchi, the site of the Tata Iron & Steel Works, has been renamed Jamshedpur by the Government of India, in commemoration of the founder, Mr. Jamsetji N. Tata. In future the postal address will be the Tata Iron & Steel Works, Jamshedpur, via Kalimati, B.N. Railway, India.

A SHEFFIELD section of the Institute of Metals has recently been formed (with Mr. W. R. Barclay as chairman and Mr. G. Bernard Brooke as hon. secretary), and an interesting pamphlet has been prepared for the information of those engaged in the non-ferrous trades of Sheffield, explaining the object of the new society.

MARSHALL, SONS & COMPANY, LIMITED, Gainsborough, have informed the secretary of the local War Memorial Committee that, as an expression of gratitude for the victorious end of the war, they are prepared to give £1,000 towards the establishment of an out-patients' department in connection with the hospital. The five directors of the firm are also giving £100 each.

THE partnership heretofore subsisting between Messrs. J. F. Hallam and C. W. M. Wilkins, carrying on business as marine and general engineers, at Hamside, Poole, under the style of Hallam, Wilkins & Company, has been dissolved. Mr. C. W. M. Wilkins will continue the business in partnership with Mr. J. G. V. Wilkins, under the style of Wilkins Brothers.

DURING the war period the amount of money paid through the Special War Fund raised by the workers, office staff, etc., of Messrs. Fredk. Braby & Company's Eclipse Works, Glasgow, reached a total of £8,862. About 550 men from the Glasgow works joined the forces, 75 of whom have made the supreme sacrifice. These figures refer to the company's Glasgow works only.

A CONTROLLING interest in Wm. Doxford & Sons, Limited, of Sunderland, has been purchased by the interests which recently acquired the Northumberland Shipbuilding Company, Limited. Mr. Rowland Hodge has retired from the Northumberland Shipbuilding Company, and his place has been taken by Mr. A. M'Ausland Kennedy, for many years a director of Wm. Hamilton & Company, Limited.

MR. F. C. BANISTER and Mr. B. J. Pearce have commenced business as steel merchants and constructional engineers at 431 and 432, Royal Exchange, Manchester, under the style of Fred C. Banister & Company. Mr. Banister has been for the past twenty-four years with Messrs. D. T. Brown & Company, of Liverpool, and Mr. Pearce is head of the firm of J. N. Pearce & Company, 17, Water Street, Liverpool.

THE operation of the Priority of Work Order, dated March 8, 1917, and the issue of certificates and permits, have been suspended, except as follows:—(*a*) From February 1 priority must be given to work and materials in accordance with directions issued by the Minister of Munitions. (*b*) All priority certificates and permits issued before February 1 will continue to be operative until March 1.

AT the Birmingham Bankruptcy Court, on Feb. 3, J. E. G. I. Smith, 19, Serpentine Road, Harborne, came up for his adjourned public examination. Debtor traded as J. E. Smith, tool and hardware merchant, at 267, Broad Street, and his amended statement of accounts showed liabilities £1,656 17s. 3d., assets £1,194 17s. 9d., showing a deficiency of £461 19s. 6d. The examination was concluded.

C. P. WINCOTT, LIMITED, of Sheffield, have received an order from the Bynea Steel Works, Limited, Llanelly, for a 50-ton Siemens furnace, making the sixth of this size furnace they have built for the company. Messrs. Wincott have also received an order from the Monmouthshire Steel and Tinplate Company, Limited, Pontymister, Newport, Mon., for a 60-ton Siemens furnace and a double continuous (gas fired) ingot-heating furnace.

IT will be remembered that the Newall Engineering Company's works have latterly been operated as a national gauge factory. We understand that the Ministry have now handed over the works to the former proprietors, Peter Hooker, Limited. The Newall Engineering Company have appointed Captain R. J. Bray, Director of the Machine Tool Section, Aircraft Production Department, as general manager of these works.

THE directors of the Blaenavon Company, Limited, have issued a circular offering ordinary shareholders 150,000 ordinary shares of £1 each at par. The shares rank for dividend as from October 1 last. The circular sets forth the additions and improvements to the company's plant, and states that the completed programme includes four new steel furnaces, which have already been erected, and which will double the company's output of steel.

THE following deletions have been made from the list of prohibited exports:—(B) Iridium and its alloys, and manufactures containing iridium; (A) telegraphs (including wireless) and telephones, and instruments and material for, including valves for wireless telegraphic apparatus; (A) tin and alloys of tin; (A) tin ore. The following headings have been added:—(A) Telegraphs and telephones, wireless, and instruments and material for wireless telegraphic and telephonic apparatus, including valves.

MR. HENRY MILLER, sales manager of J. & A. Hillman, Limited, of Dudley, is taking up the position of sales manager for the Midlands for the Woodside Engineering Company, Limited, and also for Messrs. A. P. Newall & Company, both of 50, Wellington Street, Glasgow. Mr. Miller's new offices will be in the Chamber of Commerce Buildings, New Street, Birmingham. The Woodside Engineering Company make a speciality of bright bolts and nuts, set pins, studs, and repetition work generally.

THE repatriated sailors and soldiers who enlisted from the Carron Company's service were entertained last month in the dining hall of Mungal Foundry, Falkirk. Mr. Geo. Pate, O.B.E., manager for the Carron Company, presided over a gathering numbering about 200 in all. It may be interesting to mention that 1,420 of the Carron Company's employés enlisted, and of that number 184 were killed or died of wounds, 50 were taken prisoners, and 29 received decorations.

AT a meeting of the Cleveland Institution of Engineers, held last month, a paper was read by Mr N. D. Ridsdale, entitled "Notes on the Determination of Phosphorus in Steel and Iron." Mr. Ridsdale suggests that the number of estimates for phosphorus per annum amounts to 800,000 or more, and the object of the paper is to put before analytical chemists some details which the author has found to contribute to the exact and quick determination of phosphorus by the molybdate process.

WM. HODGSON & SONS (WEIGHING MACHINISTS), LIMITED, of Salford, Manchester, have opened London offices at Cannon Street Buildings, 139, Cannon Street, E.C.4. (rooms 70 and 71). The firm have recently supplied a 100-ton railway weighbridge to the new steel works of Sir W. G. Armstrong, Whitworth & Company, Limited, at Clayton, Manchester. This machine is fitted with a live and dead set of rails, and so arranged that traffic which does not require weighing can be diverted to the dead set of rails and thus prevent any wear and tear of any of the parts of the weighbridge.

IN the Chancery Division Mr. Justice Younger has delivered his judgment in the application by W. & T. Avery, Limited, Soho Foundry, Birmingham, for an order directing the Registrar of Trade Marks to proceed with the registration of the surname "Avery" as a trade mark for weighing machines. His Lordship said that the applicants had used the word "Avery" extensively on their goods, and he was satisfied on the evidence that it was distinctive of their manufactures, and adapted to distinguish them from those of other persons. He directed the Registrar to proceed with the registration as asked.

THE NATIONAL FEDERATION OF IRON AND STEEL MANUFACTURERS are taking over the statistical

work of the Iron, Steel, and Allied Trades Federation. For this year the work will be continued in the same manner as in the past, and the National Federation are retaining the services of Mr. G. C. Lloyd as statistical supervisor, with offices at 28, Victoria Street, Westminster, S.W. Inquiries are being made into the available sources of statistical information, and particularly it is hoped to co-operate closely with the Imperial Mineral Resources Bureau and the Ministry of Munitions.

MR. R. LLOYD ROBERTS, of Brunner, Mond & Company, Limited, is suggesting to Trade Unions and employers' associations a scheme of his own for the avoidance of strikes. He proposes the formation of a permanent Employers' Central Council, with an executive of experts in industrial statesmanship, and similar bodies on the Trade Union side. He suggests that the two executives should then unite into one National Council of Industry, which should be the supreme authority outside Parliament on all Labour questions. No stoppage of work, either by strike or lock-out, should take place till the National Council had considered it.

AN arrangement has been entered into between Automatic & Electric Furnaces, Limited, of 6, Old Queen Street, Westminster, S.W.1, and August's Muffle Furnaces, Limited, of Thorn Tree Works, King Cross, Halifax, whereby the latter will supply coke, gas and oil fuel furnaces equipped with the Wild-Barfield automatic electric-magnetic detector winding of furnaces for ascertaining the change point of carbon steel. August's Muffle Furnaces, Limited, will also sell the Wild-Barfield electric furnaces jointly with the Automatic & Electric Furnaces, Limited, who have obtained the sole selling rights for foreign countries for Messrs. August's furnaces equipped with the Wild-Barfield patents.

SIR ALBERT STANLEY, in a recent speech before the Huddersfield Chamber of Commerce, said he was hopeful that it would be possible to arrange that no more priorities should be issued except under very exceptional circumstances, and that the priorities now in existence should be brought to an end some time in the early part of March. By the summer of the present year there would be at least as much tonnage afloat as there was at the outset of the war, and there was every prospect of a big slump in shipping rates in the near future. A restraining hand was to be kept on the flow of imports until our manufacturers had had an opportunity of re-establishing themselves on a peace footing, and the present system was to be substituted by the equipment of a new Ministry of Commerce.

THE housing problem at Scunthorpe was discussed at a meeting of the executive of the Yorkshire and East Midlands Divisional Council for Demobilisation and Resettlement on January 30. It was pointed out that owing to the extension of the iron and steel works at Scunthorpe, the difficulty had become very acute, some 4,000 houses being needed. A scheme for the building of what practically amounted to a new town, on modern lines, had been put forward by the Lincolnshire Ironmasters' Association, who were prepared to carry out the project. The council decided to forward to the Government Departments a resolution calling attention to the serious state of affairs, and pressing that an immediate decision should be arrived at as to the commencement of the scheme submitted by the Ironmasters' Association.

THE following headings have been deleted from the list of prohibited exports :—(B) Cadmium, alloys of cadmium and cadmium ore; (A) Carbon, coke oven; (A) Carbon, gas; (A) Carbon, pitch; (B) Carborundum, alundum, crystolon and all other artificial abrasives and manufactures thereof; (B) Cylinders, metal, capable of use for the storage of gases or liquids under pressure; (B) Ferro-cerium; (B) Silicon-spiegel; (A) Lead ore; (A) Lead, lead alloys, and manufactures of lead, or of lead alloys; (B) Molybdenum and molybdenite; (A) Piping, sheet iron or steel, for stoves or for ranges, and parts thereof; (A) Tinplate scrap, including scrapped and disused receptacles wholly or partly made of tinplate; (A) Lead-sheathed cable; (B) Armoured cable, other than lead-sheathed. The following headings have been added :—(A) Lead, dry white; (B) Molybdenum filament; (B) Armoured cable.

A HOUSING scheme connected with the extensions and alterations at the works of Cammell, Laird & Company, Limited, was outlined to the employés on February 6 by Mr. W. L. Hichens, chairman of the company. He stated that the company had acquired about 200 acres of land at Cubley, about a mile from the works, where they hoped to erect some 800 houses, and they were making a beginning with 100. They had prepared plans for building a model village at Cubley. The firm did not want the men to think that they were going to get a profit out of it, they wanted the co-operation of the men in the scheme, and they were asking them to nominate a committee of six members in order that they might consult with the firm about details. It was also proposed to erect an institute or club for everybody where they could get good meals, have indoor games, read and write, and there would be a sports club.

IN correspondence which has taken place between Sir Leo Chiozza Money and the Ministry of Munitions with regard to the sale of the national factories, the former pointed out that much of the machinery installed was of the latest type, and far better than that in the average British factory when war broke out. He suggested that the proposal was not authorised by the electors, and that it amounted to the betrayal of a public trust. He asked that, pending full inquiry into the national uses to which this important and public property might be put, the sale advertisements be withdrawn. In reply, Lord Inverforth, Minister of Munitions, stated that the question of the disposal of national factories erected during the war was a matter of Government policy, which had recently been set forth by Sir Eric Geddes in his speech of January 15 before the Associated Chambers of Commerce. The Minister was proposing to make a further statement on the subject.

THE directors of Duncan Stewart & Company, Limited, London Road Iron Works, Glasgow, gave a dinner, February 20, to the staff and to a number of friends representing associated firms to celebrate the conclusion of their war work and the inauguration of extensions to their workshops. Sir William Beardmore, Bart., chairman of the firm, who presided, gave a résumé of the history of the company from its foundation in 1864. During the war, he said, the directors, recognising that the production of steel in this country demanded permanent increase, decided to undertake the manufacture of steel works plant. New ground adjoining and east of the works was accordingly acquired. Upon this ground large works, consisting of two machine and one erecting shops, covering an area of 7,000 square yards, have been erected. These shops have been equipped with the most modern machine tools and with overhead electrical cranes capable of handling 75-ton loads, with all subsidiary equipment.

A DINNER in honour of Mr. George Terrell, M.P., was given by the National Union of Manufacturers, of which he is president, in London last month. Mr. Arthur Berkeley, who presided, said that Mr. Terrell was the mainspring of the Union. No man had done more to protect the British manufacturer, and the Union appreciated and cordially thanked him for it. Mr. Terrell said that the manufacturer had never had a voice in Parliament. Manufacturers gave employment to the greatest number of people: there was no class of greater importance to the community. That Union represented over 1,000 manufacturing firms, a considerable capital, and the employment of a vast number of persons. He frequently heard

speeches in Parliament in praise of labour, and of officials and others, but never a speech praising the manufacturers, who had played such a great part in winning the war. They had put their factories, all their machinery, and all their efforts into the service of the country unreservedly. The thanks they had had was in the form of the Excess Profits Tax.

At the recent meeting of the Federation of British Industries the following resolution was passed:—"That commissioners or representatives of the Federation be appointed in each of such overseas markets as may be determined, with functions which will include those set forth below." The suggested functions of these commissioners are to act as a centre for collecting and classifying information from all parts of the market area to which the commissioner is accredited; to institute a close inquiry into the natural resources of the country; to keep lists of likely men to act as agents for members; to retain a legal adviser in the country for the use of members; to encourage propaganda for British trade; to have a library for trade literature and catalogues; to give information as to the financial position of local firms; give advice on local and trade customs; to form a link with the representatives of the British Government with a view to securing the assistance of the Government for British manufacturers where necessary; to arrange for co-operative placing of advertisements; to create or get in touch with associations in each country composed of the principal firms engaged or interested in industry; to appoint a local board of prominent business men in sympathy with British aims to advise him generally, etc.

As we have already briefly noted, the firm of "John Thompson," Ettingshall Engineering Works, Wolverhampton, established in 1840, has been reorganised, and formed into four private limited companies, as follows:—John Thompson (Wolverhampton), Limited (Lancashire boiler and welded work), capital £230,000; John Thompson, Water Tube Boilers, Limited (patent water tube boilers), capital £170,000; John Thompson, Motor Pressings, Limited (motor frame pressings and water tube boilers), capital £170,000; John Thompson & Son (Dudley), Limited (general constructional work, steel chimneys, etc.), capital £100,000. The heads of staff of the various departments have been brought on to the directorate of the various companies, the firm having recognised in a practical manner the efforts and initiative of their employés. The governing directors are Messrs. J. Thompson, A. E. Thompson, W. J. Thompson, and S. J. Thompson, with other directors appointed from the managing staff. About five years ago a profit-sharing scheme was started, both for staff and workpeople, and this scheme has been further extended in the shape of shares in the new companies. We understand that a large sum has been given to the staff and workmen, in the way of shares, based upon years of service.

The opening ceremony of the London Iron and Steel Exchange was performed on February 11, and the Exchange will in future be open for business every Tuesday between the hours of 1.30 and 4 p.m. The Exchange is for the use of subscribers only, who must be principals, or in the case of a limited company a director or an authorised official. The entrance fee is 3 guineas, and the annual subscription is also 3 guineas, but the first 250 subscribers are exempted from payment of an entrance fee. The Exchange will be managed by a committee of subscribers, the first directors acting pro tem. until after the opening of the Exchange. Admission cards for "authorised clerks" employed by subscribers are issued at 2 guineas per annum. The following are the first directors of the Exchange:—Mr. F. L. Baldwin, of Arch. Kenrick & Sons, Limited; Mr. A. H. Barnard, of H. B. Barnard & Sons; Mr. K. Druce, of Miles, Druce & Company; Mr. C. L. Faulkner, of Bolling & Lowe; Mr. W. J. Firth, of the Grovesend Steel & Tinplate Company, Limited; Mr. H. C. Hindom, of E. Lloyd & Company; Mr. W. Massey, of Dutton, Massey & Company; Mr. H. W. Meredith, of H. W. Meredith & Son; Mr. H. J. Skelton, of H. J. Skelton & Company, Limited; and Mr. J. Whitby, of J. Summers & Sons, Limited. The following are the names of the original members of the Exchange:—Archibald Campbell, E. Lloyd & Company, J. J. Drysdale & Company, Henry W. Peabody & Company, Miles, Druce & Company, H. B. Barnard & Sons, J. Watson Slack, A. G. Kidston & Company, C. L. Faulkner, Moss Isaacs, Limited, Howard W. Meredith & Son, W. Jacks & Company, Brooker, Dore & Company, Fred Hodge, Limited, Geo. Warren & Company, Dutton, Massey & Company, Rownson, Drew & Clydesdale, Limited, Enterprise Steel Company, Limited, Smith & Wellstood, Limited, Herbert Falkner, Limited, Standard Range & Foundry Company, Limited, McArthur & Company, Redpath, Brown & Company, Limited, H. J. Skelton & Company, Grovesend Steel & Tinplate Company, Limited, Bailey, Toms & Company, Brown & Tawse, Limited, Archibald Kenrick & Sons, Limited, William J. Firth, Groggon & Company, Limited, A. Cameron & Company, Hingley & Sons, Limited, R. W. Crosthwaite, Limited, W. E. Hughes & Company, Charles Yates & Company, Thomas W. Ward, Limited, Henry Hall Summers (John Summers & Sons, Limited), Muntz's Metal Company, Limited, Cargo Fleet Iron Company, Limited, and Stanton Ironworks Company, Limited.

The amalgamation arrangements foreshadowed by the chairman at Dick, Kerr & Company's annual meeting have now been completed, and circulars have been issued to the shareholders giving details. As already noted, a new company has been formed, named the English Electric Company, Limited, which has already acquired all the shares of the Coventry Ordnance Works, Limited and the Phœnix Dynamo Manufacturing Company Limited, both of which are private concerns, and an offer is now made to Messrs. Dick, Kerr's shareholders to exchange their shares on terms which have been accepted by about 90 per cent. Further, the directors strongly recommend the transaction, and are backing their opinion by accepting the offer themselves. The English Electric Company, Limited, has a registered capital of £5,000,000, of which less than £2,000,000 will have been issued when the proposed exchange with Dick, Kerr shareholders is completed, so that it is evident the directors have the intention of considerable further expansion. As it is the company will be one of the three principal electrical manufacturing concerns in this country. The board is a particularly strong one, and representative of the leading engineering industrials. It is interesting to note that three of our main line railways are represented on the board, by Sir Charles Ellis for the Great Eastern Railway, Mr. Hichens for the London & North-Western, and Mr. Bernard Firth for the Great Northern. Equally important is the representation of shipbuilding and owning interests, with Mr. John Sampson as a director of Harland & Wolff, Limited, and Sir Alexander Gracie, of the Fairfield Shipbuilding and Engineering Company, Limited, together with the chairman and Mr. Hichens, representing respectively John Brown & Company, Limited, and Cammell, Laird & Company, Limited. The offer to the shareholders of Dick, Kerr & Company, Limited, is to exchange 6 per cent. preference shares for a similar nominal amount of 6 per cent. cumulative preference shares of the English Electric Company, Limited, and the ordinary shares for a similar nominal amount of ordinary shares of the new company. The shares in the new company issued in exchange will rank for dividend as from January 1, 1919. Shareholders in Dick, Kerr & Company, Limited, accepting the offer will be entitled to retain (*a*) as regards preference shareholders, the six months' dividend to December 31, 1918, and (*b*) as regards ordinary shareholders, a dividend for the six months to December 31, 1918, at the rate of 10 per cent. per annum. Each shareholder accepting the offer will be given the right to subscribe at par for one ordinary share of £1 in the new company in respect of each complete three shares exchanged.

Personal.

Mr. E. S. Perry has resigned his directorship of Perry & Company, Limited.

Capt. C. V. Usborne has been appointed Assistant Director of Naval Ordnance.

The late Mr. W. Shallis, engineer, White Field Bank, Heaton Norris, Lancs, left £42,009.

The late Mr. M. W. O'Connell, engineer, Marden Ash, Hillcrest Road, Ealing, left £29,462.

The late Mr. J. A. W. Anderson, of Robert Mushet & Company, Caroline Park Iron Works, Granton, left £11,209.

The late Mr. C. M. Skinner, of Newcastle-on-Tyne, resident engineer for the Admiralty in Ireland, left £25,452.

The gross value of the estate of the late Mr. J. R. Hackley, for many years secretary of Vickers, Limited, is £16,413.

Sir Arthur Duckham, of the Ministry of Munitions, has been elected a member of the Institution of Civil Engineers.

Mr. Charles Markham has been the recipient of a presentation from the employés of the Broad Oak Ironworks, Chesterfield.

Mr. T. H. Webb, managing director of J. Rhodes & Sons, Limited, ironfounders, has presented to Wakefield a fully equipped police ambulance.

Mr. E. Mond has offered £20,000 for the endowment of a Chair of Aeronautical Engineering at Cambridge University as a memorial to his son.

The Earl of Wemyss has been elected chairman of the Whitehead Aircraft (1917), Limited, and Mr. C. F. Oldham has been elected a director of the company.

The gross value of the estate of the late Mr. R. C. Thompson, head of the firm of Messrs. Robert Thompson & Sons, shipbuilders and ship repairers, is £92,664.

Lieutenant Linnell, manager of the Askam Ironworks, of the Millom & Askam Hematite Iron Company, Limited, has received a similar appointment at Tipton.

Estate of the gross value of £11,794 has been left by the late Mr. E. Jackson, for about sixty years identified with the Midland Railway Carriage and Wagon Company, Limited.

Major R. Lloyd George has been elected a director of Brown, Mcfarlane & Company, Limited, naval architects, marine engineers, iron and steel merchants, etc., of Glasgow and London.

Estate valued at £21,835 was left by the late Mr. J. Paterson, Bank Street, Carlisle, formerly blast-furnace manager at the Derwent Works, Workington, and afterwards an iron merchant and consulting engineer.

Mr. G. E. Conner, of Newcastle, secretary of the Northumberland Shipbuilding Company, has been appointed secretary to Messrs. J. Readhead & Sons, South Shields, and will shortly take up his new duties.

Mr. T. Clarkson, of the National Steam Car Company, Chelmsford, has been elected president of the Institution of Automobile Engineers. The new vice-presidents are Mr. L. H. Pomeroy, Mr. H. G. Burford, and Mr. G. Watson.

Mr. W. Betterton has resigned his position with the Glacier Metal Company, Limited, to become managing director of the Universal Die Castings and Metal Company, Limited, 7-9, Farm Lane, Walham Green, S.W.6.

Mr. A. P. Field, the manager of the file department of Jonas & Colver, Limited, Sheffield, who is leaving to take up the managership of the file department of Vickers, Limited, has been the recipient of presentations from the officials and men.

Lieut. R. A. Skelton, R.G.A., has been awarded the Belgian Croix de Guerre. Mr. R. A. Skelton is one of the sons of Mr. H. J. Skelton, of London, and is the proprietor of R. A. Skelton & Company, constructional steel work engineers and contractors, of Moorgate Station Chambers, London, E.C.

Owing to the retirement of Mr. A. F. Halstead, manager and secretary of Beyer, Peacock & Company, Limited, Mr. A. C. Rogerson has been appointed general manager and Mr. J. H. Travis secretary of the company. The London representative is now Mr. E. S. Luard, 15, Dean's Yard, Westminster, S.W.

In consequence of the death of Mr. G. Cuming, senior managing director of Harland & Wolff, Limited, Lord Pirrie has appointed Mr. R. Crighton, who is in charge of the Southampton and Liverpool branches, as deputy-chairman of the company and chairman of the managing directors, and Mr. F. F. Rebbeck, managing director of the engine works in Belfast, in addition to the Diesel Engine Works at Glasgow, of which he is already managing director.

Changes are taking place in the management of the Northumberland Shipbuilding Company, Limited. At the request of the directors, Mr. Alex. M. Kennedy, M.I.N.A., has joined the board and accepted the position of managing director, in succession to Mr. Rowland Hodge. Mr. Kennedy, who was born in Dumbarton, entered the employment of Messrs. A. McMilne & Son in 1878. In 1896 he was appointed general manager and director of the firm. Eight years ago he joined the firm of Messrs. Hamilton & Company, Port Glasgow, and retired last year. Mr. Kennedy is president of the Clyde Shipbuilders' Association and vice-president of the Shipbuilding Employers' Federation.

Mr. Thomas Walshaw is resigning, owing to ill health, his position as blast-furnace manager of the Parkgate Iron & Steel Company, Limited, which he has held for nearly twenty years. In June of last year Mr. Walshaw completed his half century of blast furnace work, having commenced in the office as a boy at the Glaisdale Blast Furnaces, in the Cleveland district, in 1868. When the latter were stopped owing to trade depression in 1875, and since dismantled, Mr. Walshaw received an appointment with Messrs. Joseph Cliff & Sons at the Frodingham Iron Works, where he remained until the year 1893, when he resigned his position to take up that of works manager at the Sheepbridge Works.

Mr. G. Ainsworth, of Consett, is retiring from the position of general manager of the Consett Iron Company, Limited, as from March 31. Mr. E. J. George, who has acted as general secretary to the firm for 14 years, has been appointed to succeed Mr. Ainsworth. Mr. Ainsworth, who has been in the service of the Consett Iron Company for about 40 years, was, at the annual meeting of the company in Newcastle in August, 1894, selected as general works manager; while Mr. Henry Holliday, of the Leeds Steelworks, Limited, was appointed secretary and commercial manager. In 1905 Mr. Ainsworth was appointed general manager of the company, with the supervision of all the productive industries associated with the firm. He has carried on the management of the concern during a critical period, and deserves a period of repose and retirement. His task had become more arduous since the demise of Sir David Dale, who for a long while acted as chairman of directors. Over five years ago, Mr. Ainsworth was one of the gentlemen selected to act on the Government's Industrial Commission. He was also president of the Steel Ingot Makers' Association, and was a member of the Iron and Steel Institute, and of the Board of Conciliation and Arbitration for the Manufactured Iron and Steel Trade of the North of England. Mr. George succeeded Mr. Holliday as secretary of the company in January, 1905.

The imports of iron ore at the Senhouse Dock, Maryport, for February were 8,600 tons, against 30,300 tons for January and 11,280 tons for the corresponding period of last year.

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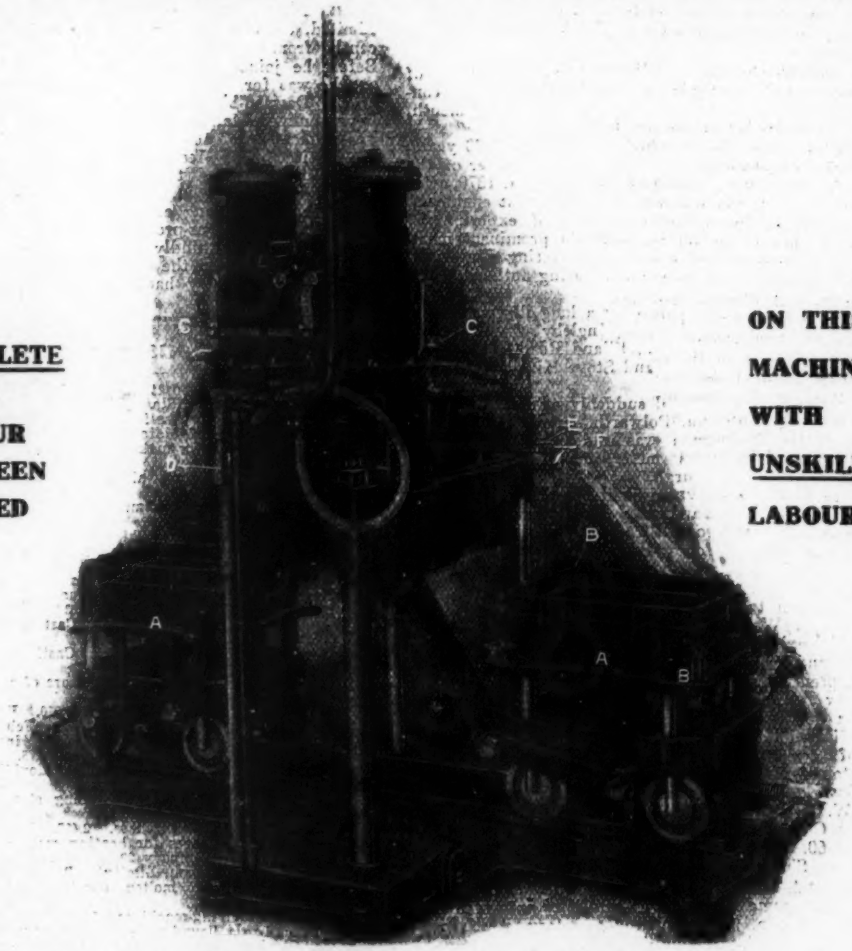

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Deaths.

THE death recently took place at Kirkintilloch, N.B., of Mr. James S. Ford, for over 36 years works manager of the Southbank Ironworks.

MR. H. DOO, assistant secretary of the Anglo-Mexican Petroleum Company, Limited, died on the 12th inst., after a brief illness.

THE death occurred last month of Mr. G. Pauling, senior director of the firm of Pauling & Company, Limited.

THE death is announced of Mr. J. Kendall, the senior assistant superintendent engineer of the Cunard Company, at the age of 62 years.

THE death occurred at Mullion, Cornwall, suddenly, on the 16th ult., of Mr. J. R. Brotherton, late Assistant Director of Contracts, Admiralty.

MR. T. K. NORTH died on February 10 at Barnes Cray, Crayford, at the age of 42 years. The deceased was a superintendent at the Crayford Works of Vickers, Limited.

MR. HENRY BERRY, head of the engineering firm of Henry Berry & Company, Limited, who sustained concussion of the brain in a motor accident last month, died at Leeds on Wednesday.

The death occurred recently, at the age of 90 years, of Mr. F. Brady. He was appointed engineer of the South-Eastern Railway Company in March, 1870, after several years' service as one of the assistant engineers.

PROF. R. C. CARPENTER, professor of experimental engineering at Cornell University, a prominent member of the American Society for Testing Materials, and a well-known American engineering authority, has just died.

THE death has occurred, after a long illness, of Mr. E. C. Ingleby, a director of Ingleby & Company, Limited, electrical engineers, Elland Road, Leeds, and also of the Electric Motor and Stove Hiring Company, Limited.

MR. A. MACKENZIE died suddenly on February 9 at his residence, Craigdhu, Polwarth Terrace, Edinburgh. The deceased gentleman was a director of Alder & Mackay, Limited, gas meter manufacturers, New Grange Works, Edinburgh.

MR. F. HARGREAVES, chairman and managing director of Hick, Hargreaves & Company, Limited, Soho Ironworks, Crook Street, Bolton, died at his residence, Broome House, Pendleton, on February 20, from complications, following an influenza attack. He was 66 years of age.

THE death took place at Liverpool, last month, of Mr. H. B. Wortley, a director of the North-Eastern Marine Engineering Company, Limited, Wallsend and Sunderland, and other companies. Mr. Wortley served his apprenticeship as a draughtsman with the late Mr. Andrew Leslie, of Hebburn.

THE death is announced of Mr. W. Cordrey, of 5, St. Mildred's Road, Lee, Kent, on January 28, at the age of 58 years. Mr. William Cordrey was a governing director of W. H. Willcox & Company, Limited, of 38, Southwark Street, London, S.E.1, and a partner of Mr W. H. Willcox in the original business.

MR. CHARLES MOORE, of Sheffield, has died at the age of 60. He had been connected with the firm of Ambrose Shardlow & Company, engineers, Attercliffe, for the past 26 years. Joining the company as its sole clerk, he became when it was converted into a private limited concern, a director and secretary, which positions he retained until his death.

THE death of Mr. G. L. Walker, secretary and director of Walker Brothers, Limited, of the Pagefield Ironworks, Wigan, took place last month. The deceased gentleman, who was in his 42nd year, was the youngest and only surviving son of Mr. J. S. Walker, head of the firm, and he began his association with the business twenty-five years ago, becoming secretary when the business was formed into a limited liability company in 1904, and combining this office with the position of director at a later date.

MR. G. CUMING, J.P., managing director of Harland & Wolff, Limited, of Belfast, died at his residence recently. Mr. Cuming had been resident head of the firm since Lord Pirrie went to London. He had been in the service of the firm for thirty years, and for the greater part of that time was principal director of the engineering department.

THE death is announced of Mr. G. Bennett, of Westwood, Christchurch Road, Pitsmoor, Sheffield, at the age of 75. Mr. Bennett was a native of Brampton, near Chesterfield, but had lived in Sheffield, and been connected with the steel trade, nearly all his life. He served an apprenticeship as tilter and forgeman, and, as a result of his efforts to improve his education, he rose to managerial positions. In 1880 he commenced business as a steel manufacturer on his own account, his firm being George Bennett & Company, the Self-Hard Works, Cornish Street. He retired from active work five years ago.

MR. THOS. WRIGHT, of Smeeton-Wright Furnaces, Limited, 56, Victoria Street, London, S.W.1, died recently from pneumonia after a very short illness. Before he joined Mr. J. A. Smeeton over 12 months ago he was for fourteen years general works manager of the Dowson-Mason Gas Plant Company, Limited, Levenshulme, Manchester. The deceased gentleman was a member of the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Iron and Steel Institute, and the Faraday Society. His loss will be keenly felt in the iron and steel industries, for he had a lifelong experience of the construction and working of gas-producing plant and gas-fired furnaces, and his kindly and generous nature and ever-ready advice on the difficult problems which confronted the industry had endeared him to a large circle of friends.

Applications for Patents.

Acme Die Casting Corporation. Casting-apparatus. 1,014. January 14. (United States, October 5, 1915.)

Acme Die Casting Corporation. Casting-apparatus. 1,015. January 14. (United States, April 20, 1917.)

Arend, J. P. Process for making alloys rich in lead. 2,496. January 31.

Arend, J. P. Manufacture of alloys of copper, zinc, and lead. 2,496. January 31.

Ballantine, W. B., and Sulman, H. L. Manufacture of alloys. 2,921. February 6.

Bower, A. S. Die-casting machines. 1,436. January 20.

Brighten, H. W. Furnaces for heat treatment of metals. 2,737. February 4.

District Chemical Company. Mixtures for carburising steel during case-hardening. 1,456. January 20.

Dixon, A. T. Melting iron and steel. 2,740. February 4.

Gingell, H., and Muntz, Sir G. A. Casting metals. 1,356. January 20.

Gingell, H., and Muntz, Sir G. A. Casting metals. 1,356. 1,483. January 21.

Griffith, A. J., and Wade, H. Manufacture of castings. 2,714. February 4.

Hall, I. Die-casting, etc., machines. 2,850. February 5.

Hall, I. Metal-melting furnaces. 2,851. February 6.

Halsall, J. H., Slater, H., and Manchester Aluminium Company. Foundry moulding-machines. 1,175. January 16.

Hickling, W. H., and Shepherd & Co., J. Moulding-machines. 451. January 7.

Hoblyn, J. B. Mixtures for carburising steel during case-hardening. 1,456. January 20.

Howe, B. Metallurgical furnaces. 2,493. January 31.

Jones, F. J. C. Furnaces for heating metal, etc., without oxidation. 1,410. January 20.

Kievits, J. E., and Kynoch, Limited. Pyrometer for measuring temperatures of molten non-ferrous metals. 2,331. January 30.

Lawrance, S. Moulding-machines. 1,469. January 20.

Lewis, E. C., Lewis Foundry, Limited, E. C., and Marchant, J. R. Devices for obtaining conductivity and radiation of heat in aluminium alloy pistons of internal-combustion engines. 2,651. February 3.

Morris, A. W. Machine for casting or working metals, etc. 2,490. January 31.

Rennie, A., and D. Manufacture of crucibles. 1,036. January 16.

Sulman, H. L. Metallurgical furnaces. 2,493. January 31.

Scovill Manufacturing Company. Metal-casting apparatus. 2,949. February 6.

Waring, E. and W. Gas-producing and steam-raising combined with steel-melting furnaces, etc. 2,997. February 7.

White, A. E. (*Davis-Bournonville Company*). Autogenous flame welding machines. 3,069. February 7.

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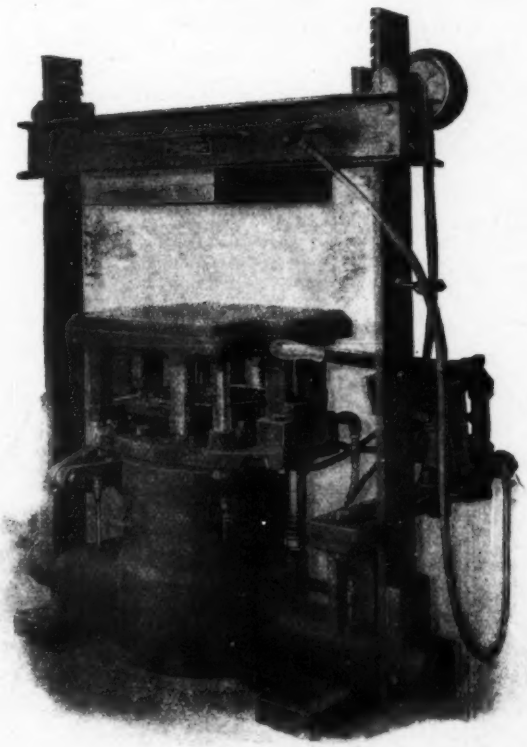

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Parliamentary Notes.

Iron and Steel Subsidies.

In reply to Mr. Acland in the House of Commons, Mr. Kellaway, Deputy Minister of Munitions, writes:—The total of the subsidies paid in connection with the manufacture of iron and steel for the three years up to January 31, 1919, amounted to about £48,500,000 (including excess of freight and insurance over the parity rates of imported ore). Of the total, the excess freights and insurance represent £31,750,000.

Value of State Factories.

Mr. Kellaway, in reply to Mr. Rose, last month, said that, including land, dwellings, plant, machinery, etc. the estimated value of the State factories at the date of the armistice was £65,000,000. This was exclusive of the national shipyards.

Legal.

"Snowballing" in Foundry Companies.

The Birmingham Stipendiary was occupied on February 4 in hearing charges of conspiracy in connection with a series of foundry companies. The concerns had been formed in succession to each other over a period of thirty years, and the transactions in question nearly all related to scrap metal and pig-iron. The defendants were H. C. Harvey, and his two sons, H. Harvey and E. K. Harvey. After hearing evidence for the prosecution, the three defendants were committed for trial at the next Birmingham Assizes jointly on the charge of common law conspiracy to defraud George Grant Brothers and others. H. C. Harvey was in addition committed for trial on the charges (1) of fraudulent conversion as a director of a company under the Larceny Act, 1916, and (2) obtaining credit by acts other than false pretences under the Debtors Act, 1869. Bail was allowed each defendant in one surety of £100 or two sureties of £50 each.

New Companies.

British Electron, Limited.—Capital £60,000 in £1 shares.

Long Acre Stampings, Limited.—Capital £10,000 in £1 shares.

Forward Radiator Company, Limited. — Capital £500 in £1 shares.

Banner Engineering Company, Limited.—Capital £2,000 in £1 shares.

Mercantile Engineers and Founders, Limited.—Capital £3,000 in £1 shares.

King's Lynn Dockyard Company, Limited.—Capital £15,000 in £1 shares.

Ernsmore Engineering Tool Company, Limited.—Capital £2,000 in £1 shares.

Isaiah Platt, Limited.—Capital £50,000 in £1 shares, to carry on the business of engineers.

G. V. Syndicate, Limited.—Capital £50,000 in £1 shares, to carry on business as engineers.

H. D. Evans' Foundries, Limited.—Capital £6,000 in £1 shares. Registered office:—John Street Foundry, Cardiff.

H. Burlingham & Company, Limited.—Capital £18,000 in £10 shares, to carry on the business of engineers.

Wilmar Engineering Company, Limited.—Capital £500 in £1 shares. Registered office: 10, Cumming Drive, Mount Florida, Glasgow.

Metal Welding Company, Limited.—Capital £1,000 in £1 shares, to take over the existing business carried on at Cheetham Street, Rochdale.

London and Montrose Shipbuilding & Repairing Company, Limited.—Capital £60,000 in £1 shares. Registered office: 28, Billiter Street, E.C.

Fletcher Malleable Foundries, Limited.—Capital £20,000 in £1 shares, to adopt an agreement with George Fletcher & Company, Limited.

Midland Motor Engineering Company, Limited.—Capital £5,000 in £1 shares. Registered office: 4, Holloway Bank, Hill Top, West Bromwich.

Machinery and Metals Sales Company (Glasgow), Limited.—Capital £10,000 in £1 shares. Registered office: 31, St. Vincent Place, Glasgow.

Beltane Tool Company, Limited.—Capital £10,000 in £1 shares, to take over the business of the Beltane

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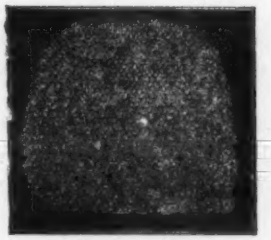
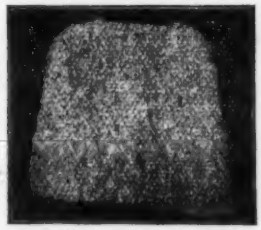
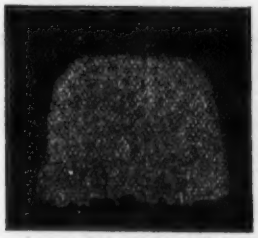




Selling Agents: WESTOBY & RAWSTRON,

224, Corn Exchange Buildings, Hanging Ditch, MANCHESTER.

Works, Hales Owen Street, Oldbury. Registered office: 94, Market Street, Manchester.

Horns Engineering Company, Limited.—Capital £3,000 in £1 shares, to take over the business carried on by A. A. Horn, at 238, Sherlock Street, Birmingham, as Horns Engineering Company.

Jig, Tool & General Engineering Company, Limited.—Capital £5,000 in £1 shares, to take over the business carried on by T. Evans as the Jig, Tool & General Engineering Company, at Foleshill, Coventry.

Woodbridge Engineering Company, Limited.—Capital £20,000 in 18,000 preference shares of £1 each and 40,000 deferred of 1s. Registered office: Woodbridge Motor Works, 70, Thoro'fare, Woodbridge, Suffolk.

Hepples (1919), Limited.—Capital £50,000 in £1 shares, to take over the businesses of dock owners, ship and engine repairers, etc., carried on by the receiver of Hepple & Company, Limited (in voluntary liquidation), at Wapping Street, South Shields.

Walsall Hardware Manufacturing Company, Limited.—Capital £70,000 in £1 shares, to take over the business carried on by J. E. Franks and M. Purchase as the Walsall Hardware Manufacturing Company, Limited. Registered office:—Ablewell Street, Walsall.

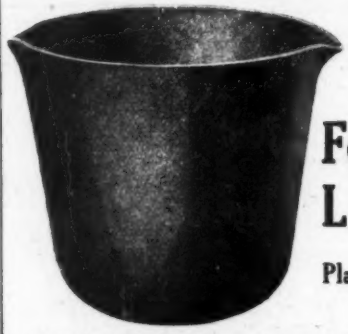
Bromford Spring Company, Limited.—Capital £1,000 in £1 shares, to acquire the existing business at West Bromwich. The first directors are:—R. Millward (chairman), H. Wood, T. Withers, B. G. Davison and E. H. Howell. Registered office:—Queen Street, West Bromwich.

Dudley, Son & Company, Limited.—Capital £2,000 in 1,000 10 per cent. preference "A" and 800 ordinary "B" shares of £1 each, and 4,000 ordinary "C" shares of 1s. each, to acquire the business carried on at Norbriggs Works, near Chesterfield, as Dudley & Son, manufacturers of spades, mining tools, etc.

Durable Engineering Company, Limited.—Capital £600 in £1 shares, to take over the business carried on by W. H. Thomson, J Whitehead, S. R. Thomson and T. Dunlop at Palace Chambers, 21, Victoria Street, Liverpool, as the Durable Tool Company. The first directors are:—J. H. Whitehead, S. R. Thomson, W. H. Thomson and T. Dunlop.

Hansen Shipbuilding & Ship Repairing Company, Limited.—Capital £50,000 in £1 shares, to acquire from the Hansen Shipping Company, Limited, the Cox's Yard, and adjacent property, in Northam, Devon. First directors: S. W. Hansen (chairman), S. J. Darling, and J. H. Reed. Registered office: Cleavehouses, Northam, near Bideford, Devon.

SANKEY



Pressed Steel Foundry Ladles

Plain or Lipped.

JOSEPH SANKEY & SONS, LD., WELLINGTON SHROPSHIRE.

The Mastery of the Air.

SIROCCO

TRADE MARK

FANS

SEND US YOUR ENQUIRIES FOR

are always successful in the struggle for the Mastery of the Air

Ventilation of Ships, Buildings and Mines, Induced Draught on Boilers, Dust Removal, High Pressure Fans for Forge Fires and Cupolas, Air Washers for Cooling and Purifying the Air, Fans for Removing Fumes or Steam, Steam Heater Units for Heating Factories and Workshops.

Davidson & Co., Limited, *Sirocco Works,* BELFAST.

Telegrams: "Durrans, Penistone." Telephone: 21, Penistone.

Established 1863.

JAS. DURRANS & SONS,

Phœnix Works, Penistone, Near Sheffield.

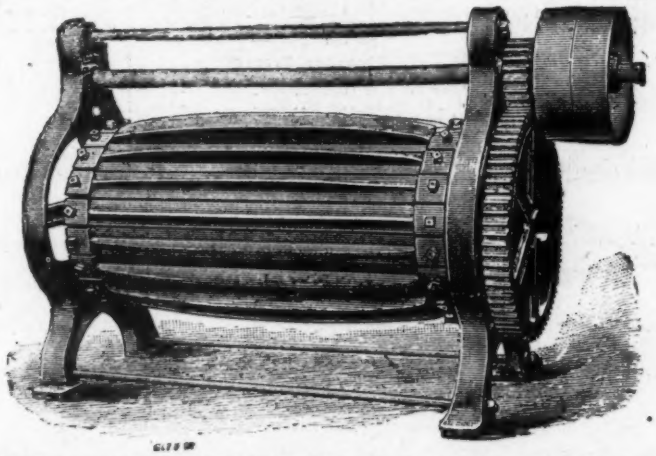
Manufacturers of all

FOUNDRY EQUIPMENTS

COMPOSITION BLACK LEAD, PLUMBAGO, CORE GUM, WHITE DUST & COAL DUST

Ladles, Cupolas, Fire Bricks, Gannister, Stone Flux, Loam and Sand Mills, Casting Cleaners, Studs, Chaplets, Pipe Nails, Sprigs, Brushes, Wire Brushes, Core Ropes, Bellows, Buckets, Spades, Forks, Riddles, Sieves, Barrows, Etc.

Improved Foundry Rattler or Fettling Drum.



These Machines are invaluable for a Foundry, doing a larger amount of work of a superior quality, in a much shorter time than can be done by hand, without skilled labour.

The following testimonial explains itself :—

"Dear Sirs,—We have been using your best Blacking for a large number of years, and always use it on our large Ingot Moulds, which, as you know, we have made up to 85 tons in weight.

Yours faithfully, THE BRIGHTSIDE FOUNDRY & ENGINEERING CO., LD.

MONTHLY PRICE LIST.

The undermentioned prices, unless otherwise specified, are those obtaining at the commencement of the current month.

CONTROL PRICES.

Pig-Iron.

	£ s. d.
East Coast hematite	
Mixed, Nos. 1, 2 and 3	6 2 6
Special, under .04 p. and s.	6 7 0
Special, under .03 p. and s.	6 15 6
Special, under .02 p. and s.	7 0 6
Scottish hematite—	
Mixed Nos. 1, 2 and 3	6 2 6
Special, under .03 p. and s.	7 10 0
Welsh hematite—	
Mixed Nos. 1, 2 and 3	6 2 6
Special under .03 p. and s.	6 15 6
Special, under .02 p. and s.	7 0 0
West Coast hematite—	
Mixed, Nos. 1, 2 and 3	6 7 6
Special under .03 p. and s.	6 15 0
Special under .02 p. and s.	7 0 6
Malleable hematite—	
Refined cupola cast	8 0 0
Ditto guaranteed analysis	8 5 0
Cast direct from Blast Furnaces—	
Small, all grades	7 10 0
Medium, white to grey mottled	7 5 0
Medium, all other qualities	6 17 6
Large, all grades	6 17 6
Warner, Special O.K.	8 12 6
„ C.P.	10 15 0
„ C.P. Blackheart	10 0 0
Cleveland, No. 1	4 19 0
Other grades	4 15 0
Basic	5 0 0
Derbyshire, Leices., and Notts.—	
No. 4 Forge	4 10 6
No. 3 Foundry	4 12 6
No. 2 Foundry	4 14 6
No. 1 Foundry	4 16 6
Basic	4 17 6
Lincolnshire, basic or foundry	4 17 6
Northamptonshire, No. 4 forge	4 7 0
No. 4 Foundry	4 9 0
No. 3 foundry	4 10 0
No. 2 foundry	4 12 0
No. 1 foundry	4 14 0
Basic	4 17 0
North Staffordshire, No. 4 forge	4 15 6
Foundry numbers	4 17 0
Basic	4 17 6
South Staffs., Shropshire and Worcs.—	
"Part Mine" forge	5 0 0
"Part Mine" foundry	5 2 6
Common Staffordshire	4 15 0
"All Mine" forge	5 15 6
"All Mine" foundry	6 0 0
"Warm Air" forge	7 5 0
"Warm Air" foundry	7 15 6
Special quality Lord Dudley's cylinder	8 7 6
Cold blast iron	9 2 0
Basic	4 17 9

Cleveland, Derbyshire, Leices., Notts., Lincs., Northants, and North Staffs. forge or foundry, selected to specified analysis 2s. 6d. extra; Derbyshire, Leices. and Notts foundry, phos. under 1 per cent., 5s. extra.

Scottish foundry and forge—	£ s. d.
Nos. 3, 4 and low grades of Monkland, Dalmellington, Eglinton and Govan	5 14 0
Nos. 3, 4 and lower grades of all other brands	5 15 6

No. 1 quality (Scottish) to be 5s. per ton above these prices.

Denby Iron and Coal Company, Ltd.—

Denby Scotch	6 10 0
Denby best	7 10 0
Denby best best	8 10 0
Robert Heath & Sons, Ltd.— Special cylinder	5 10 0
Yorkshire Iron & Coal Co., Ltd.— Special cylinder	5 10 0

Newton Chambers & Co., Ltd.—

Price delivered consumers not to exceed delivered price of Scotch foundry. (Glengarnock or equal).

To the above-mentioned prices for pig-iron a sum not exceeding 1½ per cent, on such prices may be added in the case of sales by persons other than the makers.

In all districts 1s. extra may be charged for basic cast in chills.

All per ton net f.o.t., makers' works.

High-Speed Tool Steel.

The maximum prices for high-speed tool steel have been fixed as follows:—

Finished bars, 14% Tung. 3s. 8d.
Finished bars, 18% Tung. 4s. 5d.

Per lb. basis. Extras as per authorised list. These prices are net delivered buyers' works.

The fixed prices for scrap which must be returned to steel makers' works are as follows:—

Millings and Turnings	8d.
Bar Ends	9d.

Both per lb. net delivered steel makers' works

Ferro-Alloys

	£ s. d
*Ferro-manganese 80%	25 0 0
„ export —	30 0 0

* F.o.b. Liverpool.

Non-Ferrous Metals.

Copper.

	£ s. d.	£ s. d.
Standard, Cash	76 10 0	77 10 0
Three months	72 15 0	73 5 0
Electrolytic	81 0 0	—
Tough	82 0 0	—
Best selected	82 0 0	—

Tin.

Standard, Cash	238 0 0	238 10 0
„ Three months	229 15 0	230 0 0
English Ingots	236 0 0	—
Bars	248 0 0	249 0 0
Refined	—	—

Spelter.

Ordinary	39 0 0	—
Specials	—	—
Hard	28 0 0	—
British	—	—

Lead.

Soft Foreign (net)	28 0 0	—
English	29 0 0	—

Antimony.

Regulus	—	45 0 0

Aluminium.

Virgin Metal 98/99% per ton	—

Phosphor Bronze.

Ingots.	Per ton
Alloy No. I. or II	—
III., IV or V.	—
VI or VII.	—
VIII.	—
XI.	—
Cast Strips and Ingots	—

Castings.	Per lb.
I. or II.	—
III. IV or V.	—
VI. or VII	—
VIII.	—
XI.	—
No. VII., Chill, Cast, Solid	—
„ Cored Bars	—

Delivery 2 Cwt free to any town.

10 per cent. Phosphor Copper	£40 above price of best selected copper.
15 per cent. Phosphor Copper	£60 above price B S
Phosphor Tin (5 per cent.)	£20 above price of English Ingots.

(Phosphor-bronze prices supplied by CHARLES CLIFFORD AND SON, LIMITED, FAIRLEY STREET MILLS, BIRMINGHAM).

*Chromium (Metallic).	
98/99% purity, per lb.	—

*Nickel.	
In cubes, 98/99% purity Per ton	—

Nickel Silver.	per lb.
Ingots for raising	1/4 to 1/9
Ingots for Spoons and Forks	1/4 „ 1/9
„ rolled to spoon size	1/6 „ 1/11

*Tungsten Metal Powder.	per lb.
98/99% purity per lb.	—

*Molybdenum Metal.	
98/99% purity per lb.	—

*Cobalt Metal.	
97% purity per lb.	—

Quicksilver.	
75 lb. bottle	—

* Net, Delivered Sheffield Works.

Scrap Iron and Steel.

	Cleveland. s. d.	s. d.
Steel scrap, heavy melting	—	—
Iron scrap cast (cupola metal)	—	—
London (f.o.b.).		
Heavy steel		104 6
Light „		55 0
Heavy cast		110 0
Control Prices.		
Heavy Steel Melting Scrap 105 0		125 0
Steel Planings, Turnings and Borings		65 0
Steel Planings, Turnings and Borings mixed with Wrought Iron, &c.		50 0
Steel Scrap, all other Classes		95 0
Wrought Iron Scrap		125 0
Ditto, mixed with Steel		95 0
W.I. Planings, Turnings and Borings mixed with Steel, &c.		50 0

Per ton delivered Buyers' Works.

Cast-Iron Scrap.

	£ s. d.
Hy. ord. brkn., between 1½ cwt. and 10 cwt.	4 15 0
Hy. machy., brkn., bet. 1½ cwt. and 10 cwt.	5 0 0
Cold blast, brkn., bet. 1½ cwt. and 10 cwt.	6 15 0
Ingot mould, unbroken	6 0 0
Ditto, brkn., bet. 5 cwt. and 2 tons	6 5 0
Ditto, between 1½ cwt. and 5 cwt.	6 10 0
Extra for breaking into pieces not exceeding 1½ cwt.	0 5 0
Railway chairs for re-melting	5 0 0
Heavy lumps, not above 2 tons	4 12 6
Light	4 5 0
Burnt, broken, ready for cupola	3 0 0
Burnt fire bars	4 0 0
Turnings and borings for iron and steel makers	3 5 0

Per ton f.o.r. or f.i.b. Scrap merchants' commission, 2½ per cent.; additional 10s. allowed, except for railway chairs and turnings and borings, to cover inwards carriage and handlings on sales from scrap yards.

Coke.

Middlesbrough.	s. d.	s. d.
Gas Coke	—	55 0
Foundry	65 0	70 0
Glasgow.		
Foundry Coke	—	47 6
Furnace Coke	37 0	—
London.		
Welsh or Durham Foundry, d/d London Stations in truck	45 0	53
Ditto, d/d Birmingham Statns.	44 0	46
Yorkshire, d/d London Stations, in truck	42 6	—
Ditto, d/d Birmingham Statns.	39 6	—

CONTROL PRICES OF COKE.

	s. d.
Scottish blast furnace	35 0
„ foundry	45 0
Durham & Northumbd. blast furnace	33 0
„ foundry	38 0
Yorkshire, Lancashire, Staffordshire, Notts., Derbyshire, Lincs. & Midland Counties blast furnace	32 6
Ditto. foundry	45 0
Ditto. steel melting (Sheffield Dist.)	54 0
South Wales blast furnace	37 6
„ foundry	50 6

All per ton net f.o.t. ovens.

Cumberland blast furnace d/d West Coast furnaces	37 6

SITUATIONS VACANT AND WANTED.

STEEL FOUNDRY FOREMAN requires position. Thoroughly experienced on all classes of castings up to 10 tons in green, dry sand and loam, moulding machines, Siemens, converter and electric furnace processes.—Box 168, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

MOULDERS and COREMAKERS wanted at once, medium work, constant employment. — MESSENGER & COMPANY, LIMITED, Ironfounders, Loughborough.

STEEL FOUNDRY MANAGER open for engagement; experience in Open Hearth, Tropenas, Stock Oil, Plant, and Electric (Steel Castings of every description; Machinery Moulding for all kinds of repetition work). State salary offered and tonnage.—Address, Box 178, Offices of FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

A LARGE AND WELL-KNOWN FIRM intending to concentrate on other lines of business, offers for sale Agricultural Implement Business, including Patterns and Moulding Boxes for Chaff Cutters, Oil Cake Mills, and Root Preparers, also Printing Blocks for same.—Apply, Box 180, FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

A WELL-KNOWN FIRM, who is going out of this line of business, has for sale Full Set of Patterns and Moulding Boxes for Garden Rollers, also for Cast Iron and Wrought Iron Garden Seat Standards, etc.—For particulars write Box 182, FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

FOUNDRY MANAGER, Iron and Steel, required by old-established Engineering Firm specialising in medium weight repetition work. Must be fully conversant with up-to-date methods in both Iron and Steel founding, including Electric Furnaces, Machine Moulding etc., and accustomed to handle large bodies of men. Only really live men, fully qualified in every respect, need apply.—Applications, stating experience and salary required, with copies of recent testimonials, should be sent to Box No. 176, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

FOREMAN required for well-equipped foundry in Midlands. Experienced in sand and loam work. Must be good organiser, controller of men, and competent to fix piece work prices.—State age, experience, and wages required to Box 170, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

FOUNDRY MANAGER in the Midlands requires Young Assistant (with Metallurgical Experience), Iron, Steel, Aluminium, and Yellow Metals. Good opportunity for an energetic worker. State age, experience and salary required.—Apply Box 190, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, W.C.2.

FOUNDRY PATTERN MAKER wanted in Glasgow district. One with experience in mounting patterns for American moulding machines required. Opening for suitable man, with prospects of improving position. Apply, Box No. 184, Offices of FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

RECONSTRUCTION.—Foundry Manager desires change; age 33; thoroughly experienced engineering castings, pipes, municipal work; specialised in Cupola practice and the use of Denseners; work a good practical system in costs and estimates. High references.—Address, Box 188, Offices of THE FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

SITUATIONS VACANT AND WANTED *contd.*

AGENTS required to represent company manufacturing first-class CORE BINDER. Must have established connection amongst foundries.—Apply, Box 186, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

FOUNDRY FOREMAN (34), in control of large iron-foundry, desires favourable change. A thorough practical and technical knowledge of Metallurgy, Iron-founding in all its branches, including Malleable Iron; also experience in Non-Ferrous practice; excellent training in the use of various Moulding Machines, etc.; 20 years in high-class work, jobbing, and repetition.—Address, Box No. 162, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

FOR SALE AND WANTED.

BRITISH PATENT No. 108,426, of 1916, relates to a drop flask Moulding Machine, whereby the system of moulding is rapid, accurate and inexpensive. Sale or licence.—TURNER, 28, Plumper's Road, Sheffield.

MOULDING MACHINES.—Several jar moulding machines required; capable of jarring from 10 cwts. to 1 ton. Must be in first-class condition and by good maker.—State price, etc., to Box 174, Offices of FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

CUPOLAS FOR SALE.—2 by Green's, Keighley, 30 in. dia. inside steel shell; melt about 30 cwts. per hour each; fitted wind bells and spark arresters. Also BLOWING FAN, staging, etc., to suit above. Can be inspected, Leicester.—Address, Box 172, Offices of FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

WIRE SHORTS IN COILS.
All Gauges.
Cheap.
W. PATTISON,
WIDNES.

FOR SALE.

1. New Foundry Cupola, Whiting type, by Jackman's, 3 to 5 tons per hour capacity.
2. Foundry Cupolas, Whiting type, 2 tons per hour capacity.
3. Jackman's Power Sand Riddles.
3. Jackman's Power Sand Mixers.
2 No. 3 and 2 No. 3½ Jackman's Blowing Fans, for Cupolas.
4. Fettling Tubs.

All in good condition, only having worked six months. Can be inspected at our works.

SUMMERSCALES, LIMITED.
Phœnix Foundry,
Keighley.

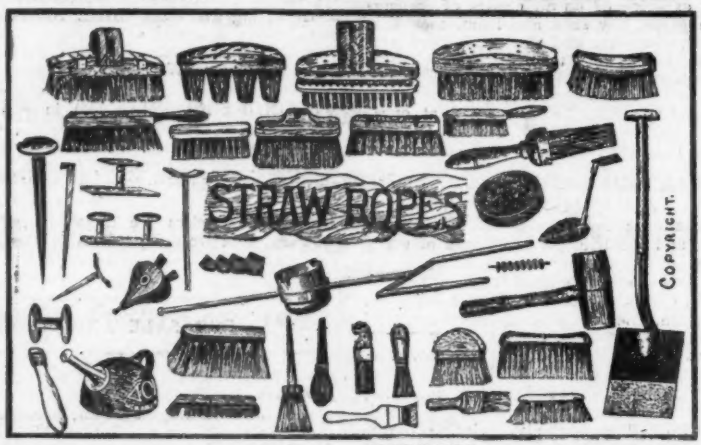
WANTED, power pig-iron breaker.—Write, stating price, condition, and where to be seen, Box 166, Offices of the FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.2.

FOR SALE.—1 Foundry Cupola, complete with spark arrester, capacity 3 to 5 tons per hour, by Evans, Manchester. 1 No. 3 Roots Blower, by Thwaites. 1 Sand Blast Arrangement, having pump with cylinder 7 in. dia. by 6 in. stroke, by Mathewson, Broadheath. 2. No. 3 Sirocco Blowing Fans for cupola, by Jackman's, Manchester. All in good condition.—For full particulars apply, SUMMERSCALES, LIMITED, Phœnix Foundry, Keighley.

Established 1890. Telegrams: Wm. Olsen, Hull.

CORE GUM. — **GLUTRIN.** — CORE OIL.

PARTING. — PLUMBAGO.



WAX CORE VENTS.

METALLIC CEMENT. — **RESIN.** — GANISTER.

Motto—"The Right Articles at the Right Price.

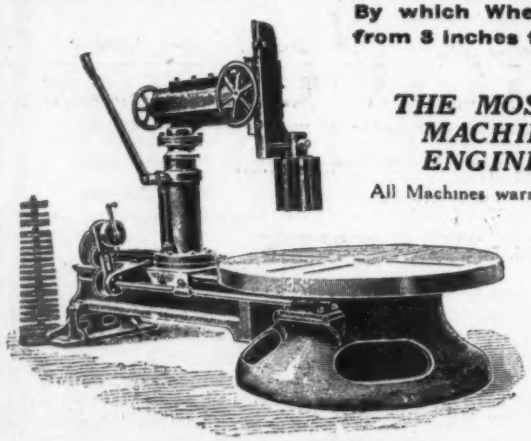
WILLIAM OLSEN, Ltd.,

Materials and Requisites for Ironwork, Brassfounders, &c.,

COGAN STREET, HULL.

WHITTAKER'S IMPROVED MOULDING MACHINE

By which Wheels or Pulleys of any description or size from 8 inches to upwards of 20 ft. diameter can be made.



THE MOST COMPLETE AND EFFICIENT MACHINE HITHERTO INTRODUCED TO ENGINEERS.

All Machines warranted to Mould with the greatest accuracy and precision.

GEARING WHEELS

Spur or Bevel, Straight Teeth and Double Helical Teeth Supplied to Consumers.

ROPE & BELT PULLEYS.

WM. WHITTAKER & SONS, LTD.,

SUN IRON WORKS, ***OLDHAM.***